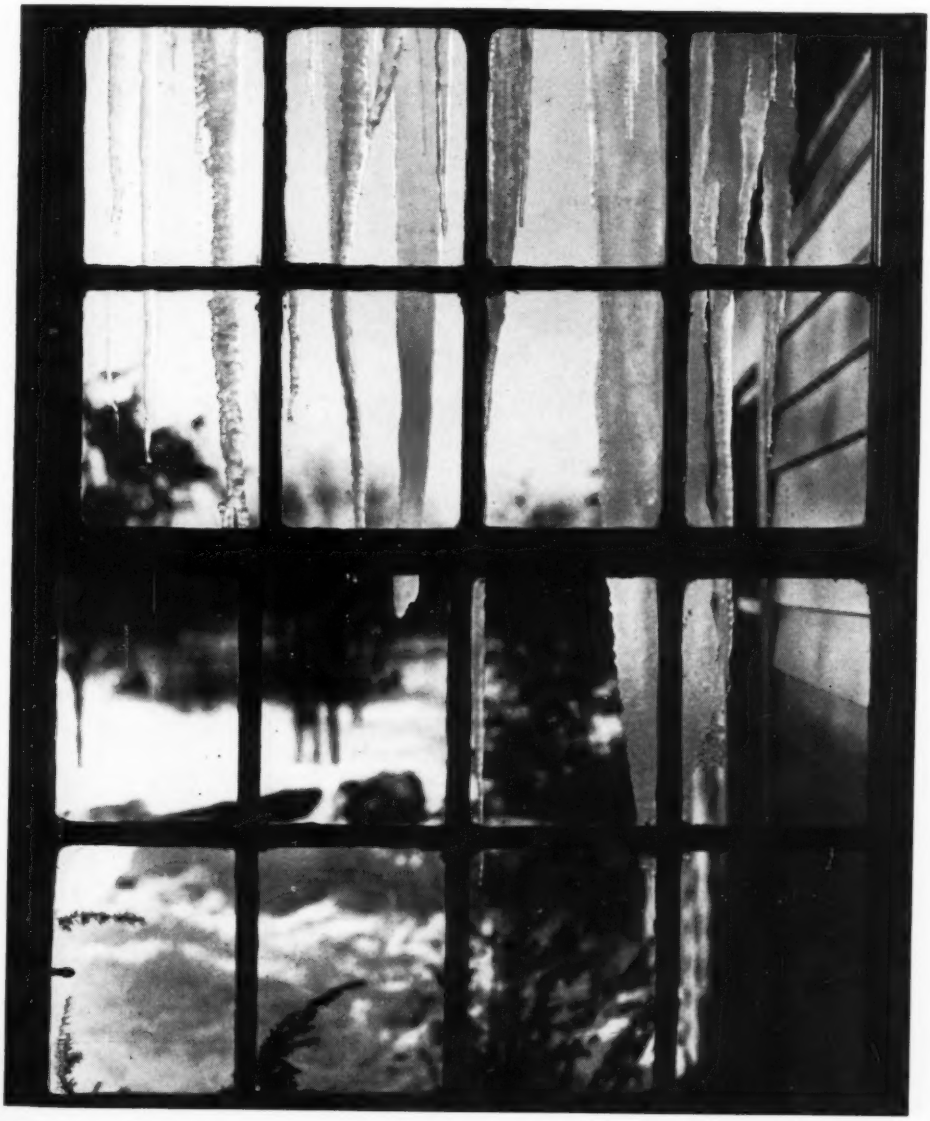
Better Crops with PLANT FOOD

December 1937 10 Cents



The Pocket Book of Agriculture

AVAILABLE LITERATURE

The following literature on the use of fertilizers in profitable soil and crop management is available for distribution. We shall be glad to send these upon request and in reasonable amounts as long as our supply lasts.

Circulars

Potash Pays on Grain (South)
Greater Profits from Cotton
Tomatoes (General)
Asparagus (General)
Vine Crops (General)
Sweet Potatoes (Mid-Atlantic)
Southern Tobacco Recommendations
Grow More Corn (South)
Fertilize Potatoes for Quality and Profits (Pacific Coast)
Fertilizing Small Fruits (Pacific Coast)
Fertilizing Citrus Fruits (Pacific Coast)
Potash Hungry Fruit Trees (Pacific Coast)
Better Corn (Midwest) and (Northeast)

Reprints

K-2 Potash Increases Corn Yields Following Sweet Clover
A-4 Recent Developments in Fertilizing Muck Soils
H-5 Connecticut Valley Soils Need Potash
I-5 Apple Trees Need Balanced Diet
B-6 Potash and Clover for Better Pastures
G-6 Profit Factors in Flue-cured Tobacco
I-6 Virginia Tobacco Needs Potash
J-6 Soybean Trends
K-6 Fertilizing Pennsylvania Cigar-leaf Tobacco
S-6 Potash for Cotton Wilt and Rust in South Mississippi
V-6 Fertilizer Needs of Red Raspberries
W-6 Strawberries Can Be Profitable (Del.)
X-6 We Did "Sumpin" About It (Cotton)
AA-6 Meet Our Old Friend Timothy
BB-6 Potash and Cotton Wilt in Central and North Mississippi
CC-6 Southern Peaches Need Potash
DD-6 Mr. Ben Qualifies as Truck Planter (South)
FF-6 Fertilization and Care of Peat Soils
GG-6 Potash for Cotton Wilt in the Mississippi Delta Region
KK-6 Fertilizers and Farm Chemurgy
LL-6 Experiments Reveal Soil Deficiencies (Cotton)
NN-6 Ohio Checks Fertility Needs of Vegetables
OO-6 Fertilized Legumes Pay Big Profits
PP-6 Deciduous Orchards Need Plant Food
QQ-6 Fertilizer Distributors for Seed Drills
TT-6 Give Peat Soils Required Potash
UU-6 Alabama's "Garden Spot" (Truck Crops)
A-7 Permanent Grassland Has Cash Value
C-7 Better Sweet Potatoes for South Carolina
D-7 Successful Strawberry Practices in the South
E-7 California Prunes Respond to Potash
F-7 Good Reasons for Fertilizing Corn (Midwest)
G-7 Mineral Fertilizers for Pasture Improvement
H-7 Potash for Cotton in the Delta Foothills
I-7 The Family Garden Deserves Planning
J-7 Meet Indiana's 1936 Onion King
K-7 The Tung Oil Industry in Mississippi
M-7 Better Crops of Better Quality (Corn)
N-7 Will Potash Benefit Your Apple Orchard
O-7 Prevent Blackening of Irish Potatoes
Q-7 The Agricultural Future of Puerto Rico
R-7 Results with Potash in Eastern Virginia
S-7 Growing No. 1 Tomatoes for Hoosier Canners
U-7 Fertilizers for Better Asparagus (Northeast)
V-7 Feeding Cattle Minerals Through Better Pastures
W-7 A Modern Pioneer—J. W. Hadden (Cotton)
X-7 On Apple Orchards Use "Congenial" Fertilizers (Northeast)
Y-7 Asparagus in Ontario
Z-7 Apply Boron to Prevent Darkening of Turnips
AA-7 Potato Improvement in Wisconsin
BB-7 Fertilizer Response on Colby Silt Loam
CC-7 Replace Plant Food Losses in Crops
DD-7 Circle M Ranch Makes A Profitable Comeback
EE-7 The Role of Potash in California Soils
FF-7 High Potash Fertilizers Grow Better Tomatoes
GG-7 Shall It Be Soil-mining or Soil-building
HH-7 High Potash Fertilizers for Fall Use
II-7 Fertilization of Bulb Plants.
JJ-7 Atkinson Demonstrates That It Can Be Done
KK-7 Minor Elements in Cotton Fertilizers
LL-7 Fertilize to Control Cotton-belt Erosion
MM-7 Raising Quality Fruit on a Large Scale
NN-7 The Use of Soil Tests in Conservation
OO-7 Study Starvation signs on Tobacco and Cotton
PP-7 We Do Some Terracing (South)
SS-7 Conserving the Benefits of Soil Conservation
TT-7 Take the Guesswork Out of Wheat-growing
Orchard Fertilizer Practices Determined by Diagnosis
How to Determine Fertilizer Needs of Soils
Some Results of Mineral Deficiency Studies

AMERICAN POTASH INSTITUTE, INC.
INVESTMENT BUILDING **WASHINGTON, D. C.**

Better Crops with PLANT FOOD

The Whole Truth—Not Selected Truth

R. H. STINCHFIELD, *Editor*
Editorial Office: Investment Bldg., Washington, D. C.

VOLUME XXI NUMBER TWELVE

TABLE OF CONTENTS, DECEMBER 1937

Candle Glow 3
A Christmas Reverie by Jeff

Certain Elements Affect the Growth of Turnips 6
Discussion by M. B. Davis and Wm. Ferguson

Make Your Fish Pond Pay Dividends 11
Dr. Ross E. Hutchins on Pondfish Culture

Growing Tomatoes with Chemical Fertilizers 13
Recommendations by Victor A. Tiedjens

The Committee on Fertilizer Application Meets in Chicago 16
Resumé of the Research Program

Crops and Fertilizers in the Black Belt Section 19
Described by L. O. Brackeen

Mississippi "Sweets" Need More Potash 20
F. J. Hurst Gives Convincing Evidence

New Year Resolutions 22
As Suggested by A. B. Bryan

American Potash Institute, Inc.
Investment Building, Washington, D. C.

J. W. TURRENTINE, *President and Treasurer*
G. J. CALLISTER, *Vice-President and Secretary*

THE LAST STAND AGAINST WINTER'S GRIP.

Better Crops with PLANT FOOD

PUBLISHED FOR THE AMERICAN POTASH INSTITUTE, INC., INVESTMENT BUILDING, WASHINGTON, D. C. SUBSCRIPTION, $1.00 FOR 12 ISSUES; 10c PER COPY. COPYRIGHT, 1937, BY THE BETTER CROPS PUBLISHING CORPORATION.

VOL. XXI WASHINGTON, D. C., DECEMBER 1937 No. 12

The light of past years still makes

Candle Glow

Jeff McDermid

CHRISTMAS doings of long ago have dangled in my fancy lately, not in the softened callousness of a Scrooge, but in the wistful consciousness of a scribe. Santa Claus was a hardy old annual in those times and had his abode near the north pole. Kids believe nowadays that he resides in Washington and drives his reindeer with red tape.

Believe it or not, I was almost ready for long pants before I reluctantly renounced Santa as a personal reality. It was mighty tough for me to remove his ruddy countenance from the boyish hall of living immortals, like Buffalo Bill, Jim Corbett, and Richard Pearson Hobson. So rather sadly, as one buries an old dog, I slipped his picture off the wall and placed it in my nook of acknowledged mythical heroes, where he still holds quiet communion between stiff yellowed leaves with the demi-gods and paladins who wave their wands and swords eternally in Bullfinch's "Age of Fable" and the "Idylls of the Kings."

Jim Corbett soon followed Santa into the limbo of the lost, but in his case I had a red-haired Australian blacksmith to stick up in his place, whereas the banishment of the whiskered saint left a glaring void in an adolescent's world of realism.

I recall that for a long spell afterward when I awoke of a winter morning to smell the batter cakes, this absence of Santa Claus (resolutely

facing Corbett's mighty fist with grinning nonchalance) stirred within me yearnings to hang up my socks again. But I have steeled myself against this weakness for lo, these many jumbled years; no matter how great my expectancy, how gaudy the socks, or how convenient the blazing hearth.

FROM that date thenceforth the coverings of my pedal extremities were reserved for the wash line and the darning basket, although it is true that metaphorically, I have often hung them up on some absorbing scheme, only to awaken not to find them filled, but vanished with my shirt!

I have never spent the holidays in Dixie land, though I am aware that we import our gorgeous holly wreaths and mistletoe from there, as well as sundry warm-hearted customs incident thereto. No doubt I should feel just as merry and generous as my temperament and purse would allow were my lot cast in the Deep South at the Yuletide; but for awhile it might be difficult, as the winter climate there is not the rough and tumble sort which makes us naturally hasten toward the ingle-nook and the toddy bowl. A gracious, balmy, outdoorsy Christmas would find me so excited that I might trim the tree with Roman candles and festoon things with firecrackers — punch or no punch.

This preface is inserted to pacify the readers who were fetched up under a more salubrious Santa Claus than I catered to. It is not my desire to thrust the congealed Christmas of Yankee-land down the necks of our Southern friends, whose hospitality and sentiment can only be matched by their tolerance of a provincial essayist whose only working knowledge of cotton is that it proves useful in fringing the mottled jowls of some lank-shanked Saint Nicholas in the department store business.

Moreover, I am persuaded that were a Southern family to exchange abodes with mine for a couple of Christmases we would all soon become acclimated to the particular brand of good cheer that tradition and climatic conditions have bred into us through generations —since the Pilgrims went north with grim faces, and Lord Baltimore and Cap John Smith (it should have been "Colonel") chose to populate the opposite clime.

Indeed, we may say quite freely that the way we have differed from each other in sectional details of Christmas joy-making has led to minor misunderstandings and crops of ignorance touching upon our other circumstances, policies, and programs. Happily it is easily visualized that we possess a binding tie, both in the deeper meaning of Christmas that we in both regions mutually share, and likewise, if we ponder on it, concerning most of the other strands in our loom of American life. They may appear twisted, irregular, and often of a different hue, but taken as a whole they pattern out a pretty strong shank of tweed—all wool and a yard wide!

THANK heaven, most of us both north and south are poor in worldly goods and rich in spirit, courage, and heritage. As soon as the bulk of a nation become "newly rich" and thoroughly conscious of their nicer playthings, the same thing happens to them that happens to a pampered, snooty kid whose every day is Christmas. They forget how hard Grandpaw worked to earn a dollar or how hard Grandmaw planned to take it away from him so it would be properly spent.

Being thankful over relative poverty does not signify the degrading form of poverty that crime and ignorance fatten on. A useful, hardy, upstanding kind of poverty is what I mean. It's the kind that keeps you in sympathy with the fellow who turns

an honest penny, pays his debts, and enjoys a few simple things at Christmas.

Humble folks who make the most of what they possess without grumbling, and the well-to-do who share

their joys with less fortunate are usually the happiest ones at this season. The situation is emblematic of the Son of Man who was also the Son of God—one who mingled with humble carpenters and fisher folks, and yet who had the power if he chose to claim the wealth of the world as his right.

Even the avowed skeptics and pretended unbelievers, the infidels and the agnostics, are not callous to the spirit of charity or unresponsive to the beneficent effects of love and good will. Therefore there is always something universal and humanizing in the Christmas season, which we all admit would do us more service if it persisted through the year.

The pealing of the bells and the sweet solemnity of evening candle glow, the distant echoes of the jolly carolers, the combination of present, hushed expectancy and hallowed remembrance—these find a response in all normal humanity who still deserve the name.

Those who happily possess a parental diary or journal are particularly fortified when modern plans go wrong. More especially are they brought face to face with the conditions and circumstances surrounding the holidays of their childhood.

They find that there were scant pleasures as we know them now, and the amount of money then available for a family's entire Christmas spree would not buy a desirable gift for one member of the modern household. As standards of life rise (and who says they shouldn't?) we may be pardoned for looking backward if for no other reason than to see how far most of us have come since the days of relative universal privation.

I doubt if any other single generation has been able to see such a swift change from what were the luxuries of youth to the everyday necessities of middle age—doubly emphasized of course at Christmas. For instance, in my native burg there were in my teens just four "horse and buggy blocks" and tie-posts, and as many backyard barns for the whole length of wood-paved Maple Street; whereas today you cannot find a place to park anywh e along that concrete causeway, and every domicile boasts its own garage. Did some of the old spirit of Christmas vanish with the jingling sleigh-bells? If so, I doubt if a "honk" will bring it back.

YET peradventure by 1980 some of my youthful "contemptuaries" will look back from their air-conditioned, centrally heated, television equipped parlors, with elevators ready to shoot them to their take-off platforms on the roof—and sort of sigh for the old familiar smell of gasoline and yearn for a squeaky brake or a raucous horn to remind them of queer old Dad and his six-cylinder Christmas! Like me, they too may ransack the attic and thumb over an ancient diary, as a sort of mental pinch in the arm to prove they are not dreaming.

Consulting my Mother's penciled

(*Turn to page* 47)

Certain Elements Affect The Growth of Turnips

By M. B. Davis and Wm. Ferguson
Central Experimental Farm, Ottawa, Canada

DURING recent years much attention has been attracted to the turnip on account of the rather remarkable results which have been obtained by the use of boron as a corrective for the trouble known as brown heart.

Attention was attracted to the possibility of boron as a cure for brown heart by the results from Germany, where heart rot of sugar beets had been correlated with a lack of boron. The earliest demonstration in Canada to indicate the efficacy of boron in the control of brown heart of turnips was in the Maritime Provinces. Field trials conducted by the Experimental Farms Branch indicated satisfactory control when 10 pounds of borax were applied per acre. This work was later reported by MacLeod and Howatt in the December 1936 issue of Scientific Agriculture, and still later a bulletin for practical use was issued by Hurst, Division of Botany, Experimental Farms Branch, Ottawa, Canada.

In an endeavour to study the role of boron in the turnip plant, Hill and Grant conducted experiments with turnips in sand cultures which were reported in Scientific Agriculture, May 1935. This work, together with subsequent experiments and the field trials of others, has given much inter-

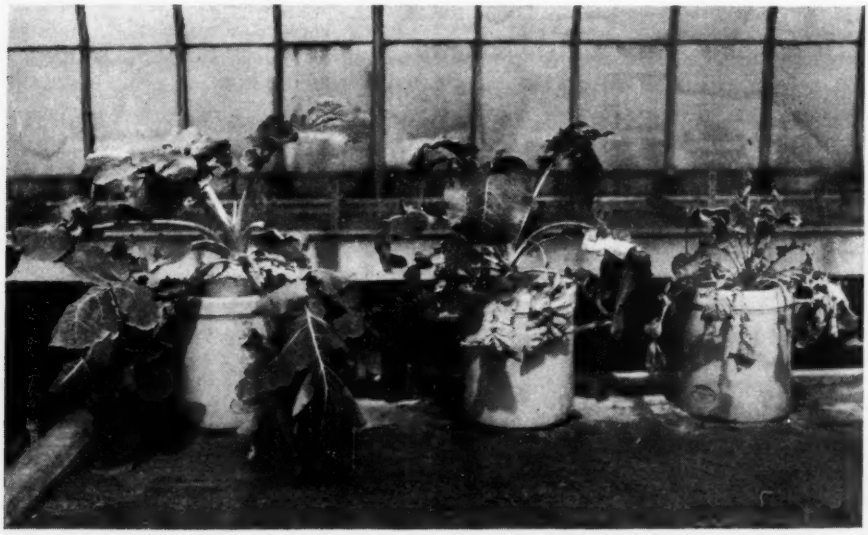


Fig. 1—Turnip plants showing the effect of boron on growth and vigour. (Left) Boron fed at the rate of 1 part per million, (center) at the rate of .25 part per million, (right) plant received no boron.

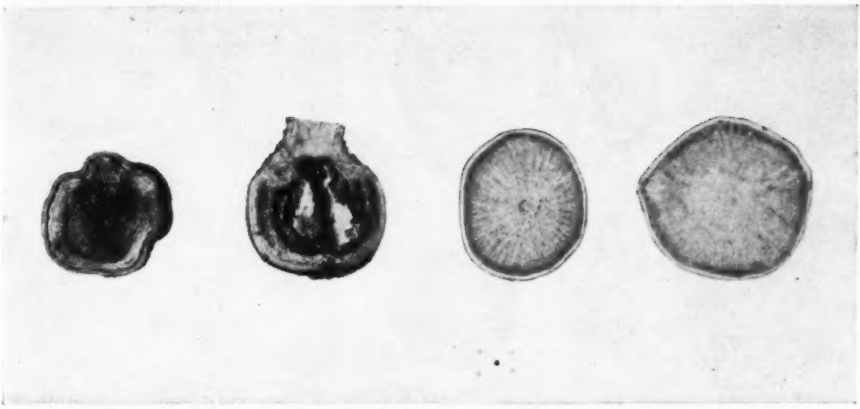


Fig. 2—The two turnip roots on the left showing hollow heart were fed boron at the rate of .25 and .50 part per million. The two roots on the right which are free of disorder were fed boron at the rate of 1.5 parts per million in the nutrient solution.

esting material of a practical nature.

There is, of course, no longer any question as to the absolute necessity of boron for the successful growth of the turnip plant. Unless boron is included in the feeding solution, growth ceases at a very early stage, the root or tuber does not develop and eventually decays, and the foliage presents very definite symptoms of malnutrition.

Effect of Boron

Figure 1 shows what happens when boron is withheld from the feeding solution, as compared with increasing amounts of the element up to one part per million, while Figure 2 shows a cross section of turnips grown with varying amounts of boron in the feeding solution.

The interesting thing is that while full sized turnips developed with only one-half part per million of boron in the feeding solution, the turnips were so bad with hollow heart and browning that they were practically useless. In the field, the trouble may vary from cases as severe as that depicted in Figure 2, due to only .50 part per million of boron, to a very mild "water core" or glossy appearance of the central area which only slightly affects the actual value of the root.

The most absolute symptom for diagnosis for boron deficiency in turnips is the occurrence of brown heart, but in addition the plant may exhibit foliage, stem, and other external symptoms, all of which may be described as follows:

The plant gradually becomes stunted or dwarfed in appearance. The leaves are smaller and less numerous and gradually assume a variegated colour, which appears as a mixture of yellow and purplish red blotches over part or all of the leaf, while the stalks of such leaves usually show a longitudinal splitting. The root does not grow to full size and under conditions of severe boron deficiency remains very small, distorted, and has a rough, unhealthy, grayish appearance instead of a clean, smooth, yellow surface. Often the surface will be quite wrinkled and cracked.

On cutting through a root, boron deficiency is shown by the familiar brown heart which appears as dark brown, water-soaked areas in the central flesh of the root. It may vary from a few, small, scattered, isolated spots to large water-soaked areas, and even result in a hollow centre, with all the inner flesh of the root badly discolored depending upon the severity of the deficiency.

At what stages in the life of the

Fig. 3a—Side and section views of turnips. (1) Complete nutrient solution. (2) Lacking boron after first month. (3) Lacking boron after 2 months. (4) Lacking boron after 3 months. (5) Lacking boron first month, then complete.

3b—(1) Lacking boron first 2 months, then complete. (2) Lacking boron first 3 months, then complete. (3) Solution lacking boron, boric acid sprayed on plants first month. (4) Same as 3, boric acid sprayed first 2 months. (5) Same as 3, boric acid sprayed first 3 months.

3c—Nutrient solution lacking boron in all cases. Boric acid sprayed on plants (1) after first month, (2) after second month, (3) after third month, (4) check—no spray.

plant is boron required? In order to answer this question, plants have been grown in culture solutions with boron supplied or omitted at different periods as follows:

Group I—Boron fed throughout the life of the plant.

Group II—Boron fed to the end of the first; the second; and the third months of the life of the plant, then omitted from the solution.

Group III—Boron omitted from the feeding solution to the end of the first; second; and third months of the life of the plant, then supplied in normal amount.

Can Be Reclaimed

From these groups of feedings, it became evident that the plant could be starved for boron for the first month and then brought to normal development by the introduction of boron to the feeding solution (see Figure 3 and Figure 4). The starvation of plants for 2 months with subsequent feedings of boron produced roots which externally appeared normal but which possessed a small amount of brown heart.

In the reverse series where boron was fed only during the early life of the plant, the results were hardly as expected. With boron fed for the first month and then withheld from the feeding solution, very small turnips were developed with severe brown heart. The feeding of boron for the first 2 months only, produced larger roots but with severe brown heart, and the feeding of boron for the first 3 months only, produced normal sized roots with a moderate amount of brown heart largely confined to the epidermal region.

It is very evident from these results that the feeding of boron in the later life of the turnip is of more benefit than the feeding of boron in the early stages only. It is possible that this is due primarily to the fact that the plant is unable in its early life to store boron for future use, but may start growth and continue for a time in its absence.

From the observations made on the various series and the results obtained, as seen in the illustrations, it can be said that boron is not essential for good root development during the first 2 months and certainly not during the first month after transplanting. It is after this time that root development is greatest. This would indicate that the time of greatest root development coincides with the time during which the plant has its greatest need for boron.

The exact role that boron plays is not yet evident, but previous work in this Division indicated a much lower accumulation of calcium in the roots of high boron plants than in the roots of low boron plants. Warrington, in the Annals of Botany, Volume 48, 1934, has suggested some kind of relationship between calcium and boron, the exact nature of which is not yet determined.

Is Spraying Successful?

It has long been known that plants may absorb through their foliage certain amounts of plant food and apparently translocate these to other regions.

Since boron is necessary for the proper root development of the turnip, this plant affords a good means of determining the ability of boron to be translocated from the leaves to the roots. To eliminate any possibility of the spray being applied to the soil or sand and thus entering in minute amounts through the roots, the pots were covered carefully with rubber and a small atomizer employed in some cases, while in other cases, the boron was applied to the foliage by brushing.

Observations on the condition and amount of foliage and on the size and appearance of roots clearly prove the plant can and will absorb boron through the leaves and utilize it for greater growth. The fact that the

characteristic foliage symptoms were absent from the plants while they were being sprayed with boron indicates that the boron was absorbed, whereas the check plants receiving no boron showed very pronounced foliage symptoms. The healthy appearance and size of roots from plants sprayed with boron also prove that the boron is not only absorbed by the leaves but is transported through the plant to the various regions where boron is required for growth and development.

Root-feeding Preferable

Laboratory analyses of young and old leaves, stems and sections of the roots of plants receiving a boron spray, and of plants receiving no boron show on the whole a higher concentration of boron in the various parts of the sprayed plants than in the same parts of those plants lacking boron.

However, the efficiency of this method of feeding boron to turnip plants is not as great as feeding through the roots. Not one of the sprayed plants at the final examination yielded a root which showed as little brown heart as those plants receiving the corresponding boron feeding through the sandstone, and whereas some of the latter were free of brown heart as may be seen in Figure 3, yet there was brown heart present in every root of a sprayed plant. It is possible though that a stronger spray solution or more frequent sprays would give just as excellent results as were obtained by feeding through the roots.

For the development of any plant it has always been considered that adequate amounts of nitrogen, phosphorus, and potassium, calcium and magnesium were essential. This is in the main true, but a recent deficiency or starvation experiment with turnips has indicated the positive necessity of potassium in conjunction with nitrogen for the development of this crop. Furthermore, the balance between nitrogen and potassium, as with several other crops, appears to be of primary importance.

Excess feedings of nitrogen in the presence of small amounts of potassium have resulted in small root development. Deficient nitrogen, either in the presence or absence of abundant potassium, has resulted in decreased size of root. Deficient feedings of phosphorous have also resulted in decreased size about equal to that obtained from a nitrogen deficiency. Actual starvation for phosphorus permitted a considerable root development, while actual starvation of potassium resulted in the development of a root stock only, with a few fibrous feeding rootlets (see Figure 4). The elimination of magnesium or calcium from the feeding mixture did not

(*Turn to page* 41)

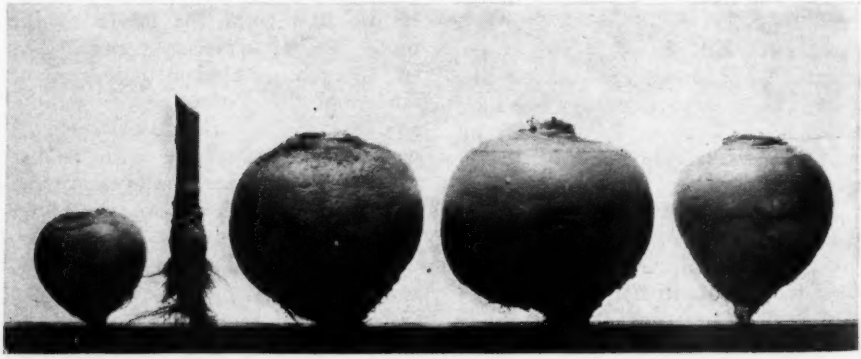


Fig. 4—Showing the effect of deficiencies of certain elements on turnip roots. From left to right, lacking phosphorus, lacking potassium, lacking magnesium, lacking calcium, and lacking half the normal supply of potassium.

Hooking a big one like this makes waiting worth while.

Make Your Fish Pond Pay Dividends

By Dr. Ross E. Hutchins

State Plant Board, State College, Mississippi

IN THIS country there are thousands of fish-ponds varying in size from mere puddles to large lakes. Few of these are managed in such a manner as to produce the maximum amount of fish. The average pond owner seems to be under the misapprehension that all a fish needs is water to swim in. This, of course, is anything but true, just as it is not true that all a cotton plant needs is some dirt to grow in regardless of the soil elements contained therein.

Pondfish culture is a complex subject, and volumes have been written about it, no two of which agree in all respects. There are, however, some general principles which might well be considered. It should be understood that the fish pond can be made a paying proposition if managed properly, not only from the standpoint of pleasure and satisfaction, but of actual food value as well. The time and money it necessitates are usually little when compared to the results.

First let us consider the pond, or rather the area where the pond is to be. A large majority of the smaller ponds, especially in the South, are rain ponds depending for their water supply upon rain in the immediate vicinity. The area selected should have as large a watershed as possible, then

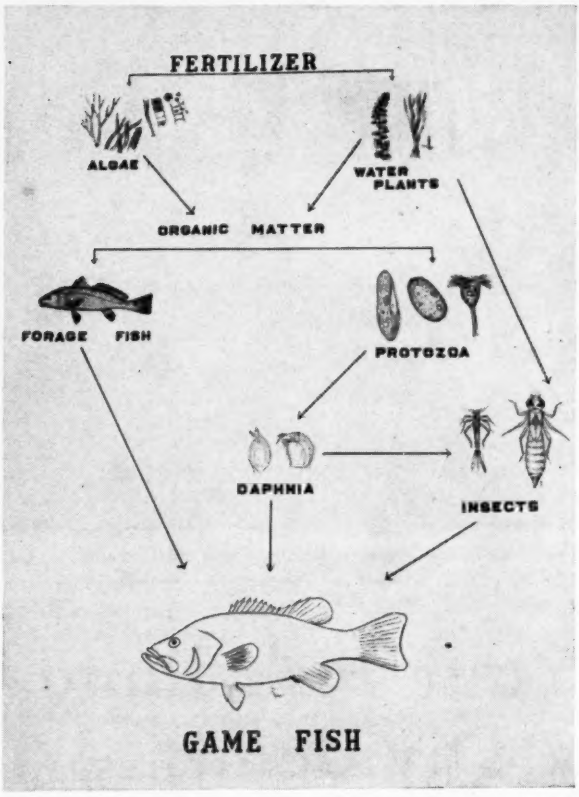


Diagram showing how pond fertilizers are transformed into fish.

too the cost must be considered, and the dam located where as little work and materials as possible are required. Generally speaking, a pond to be truly successful should be at least 1 acre in area and should have a general slope toward one point where a drain pipe is located. This drain pipe is very important, yet in the writer's experience very few ponds are so equipped. An easy means of drainage is desirable because it is often necessary to remove the water to destroy undesirable or predacious fish, or for the control of aquatic vegetation.

The pond at its lowest point should be at least 5 feet deep, so that during hot weather the fish can seek the cool depths. Much of the area under water should be relatively shallow, as it is in the shallow water that most of the fish food is produced. When vegetation dies and sinks to the bottom in deep water, it is more or less lost; but when it is deposited in water only a foot or so in in depth, it is fed upon by countless kinds of microscopic organisms which are in turn fed upon by fish.

This brings us to the subject of fish food, and a very important phase of fish culture it is, too. It is always best to provide natural food for fish rather than to feed artificially. In the fish pond there are very definite cycles of life going on. Many forms of plant life grow in the water from microscopic algae to larger floating vegetation. These plants die and are fed upon by bacteria, which in turn form the food of single-celled animals called protozoa. Now these protozoa are devoured by small crustacea called water fleas, and fish, especially the minnows, feed on the water fleas as well as organic matter.

Let us now go back to the beginning—the plants—again. What do they feed upon? Like all plants they manufacture their own food with the aid of sunlight, but in this process certain mineral elements are absolutely necessary. Just as cotton will not grow on worn-out land where no fertilizer has been applied, so these aquatic plants will not grow in water not containing the necessary foods. These are chiefly nitrogen, phosphorus, and potassium, and are the same elements as in commercial fertilizers used on farm lands. This fact was strik-

(*Turn to page* 39)

Growing Tomatoes With Chemical Fertilizers

By Victor A. Tiedjens
New Jersey Agricultural Experiment Station, New Brunswick, New Jersey

THE old question whether high yields of tomatoes can be grown with chemical fertilizers is always before us. The answer, however, is not always so evident. Occasionally one finds a grower who has grown better crops with chemicals than with manure. In the days of abundant manure the question did not have the importance it has today, because many growers have not used manure for a number of years. Some have been more successful than others. There are certain plant-food materials absolutely essential to a good crop of tomatoes, and manure has some of each of these ingredients in proportions that are suitable for the crop under average soil conditions. As a result growers who have used manure have fared better than those who have used only chemical fertilizers. Many growers who have substituted all the manure with chemicals have not fared so well, not because chemicals will not produce the results, but because they have not substituted all the elements carried in manure.

Yields and quality of tomatoes are closely associated with the amount and kind of plant-food material available in the soil on which they are grown. If it takes a certain amount of plant-food material to produce a

This picture illustrates the growth made by tomato plants when shifted from a complete nutrient solution when 8 inches high to one having one of the elements left out as indicated. Left to right: lacking calcium, nitrogen, potassium, phosphorus, magnesium, and a complete solution.

10-ton crop of tomatoes and that amount is not available in the soil, then the grower must supply the missing material or take a smaller yield. That seems an easy accomplishment, but if the average yields are any criterion of how well the grower has supplied the missing material he has done a poor job, because yields and quality are too low to pay for the fertilizer, to say nothing of his other expenses. What then is the difficulty?

Manure Not Enough

There are, of course, weather conditions, such as rain and wind storms, which destroy a large percentage of the crop and which have nothing to do with crop fertilization. Dry weather in certain localities reduces yields each year. Insects and diseases likewise take their toll. However, such agencies take a heavier toll of poor fields than good fields. This leaves us with the conclusion that growers have not supplemented the manure with the right kinds of chemicals.

Many cultural practices may affect yields adversely. Poorly grown plants set too late in the season, or not cared for after they are set, will not produce a good crop with the best kind of fertilizer. However, we are safe in saying that a soil well prepared and properly fertilized will go a long way to minimize the harmful effects brought about by weather conditions or unsatisfactory cultural practices. Plants growing on a "growth supporting soil" will make a rapid comeback even when whipped and soaked by an August storm of a week's duration which growers often experience in the tomato areas of New Jersey. Fields improperly fertilized fail to recover following these deluges. What then is a substitute for manure?

A 10-ton application of manure to an acre of ground would supply approximately as much nitrogen, phosphoric acid, and potash as would be supplied in 1 ton of 5-3-5 mixed fertilizer, provided fresh manure, including liquids, is put on the soil. If the manure was exposed to rains, much of the nitrogen and potash may have been lost, so that the figure might be a 3-3-2. However, there are still some advantages in this manure. It is in such a form that it is not all available to the plants at any one time. It becomes available as the plants need the food material. If soil moisture reaches a low level, only a small amount of salt is present in the soil, and the effect of dry weather is minimized.

Manure has other ingredients. It has calcium in large quantities. It has magnesium, sulphur, boron, manganese, iron, copper, and many other materials. So one might ask, how far has the grower gone in substituting all these plant-food materials with chemicals which he formerly supplied with manure?

Soil Test Helpful

The quick soil test has come to the aid of the grower in determining the level of the various essential elements needed by the tomato plant. By standardizing such tests with crop growth it has been possible to set up arbitrary standards or requirements for the various crops. Growers can determine how closely they have substituted nutrients by means of chemicals for those formerly supplied in manure. The organic matter added to the soil in manure must not be overlooked.

A soil survey, showing plant-nutrient levels on a number of farms in one county in New Jersey where much of the soil is of a sandy nature, showed that more than 60% of the farms were too low in calcium, phosphorus, potash, organic matter, and nitrogen to support even a low yield of tomatoes or other vegetable crops. This survey also showed that those growers who had obtained good yields of tomatoes had fertility levels of high calcium, medium phosphoric acid, and medium to high potash readings with an organic matter content above

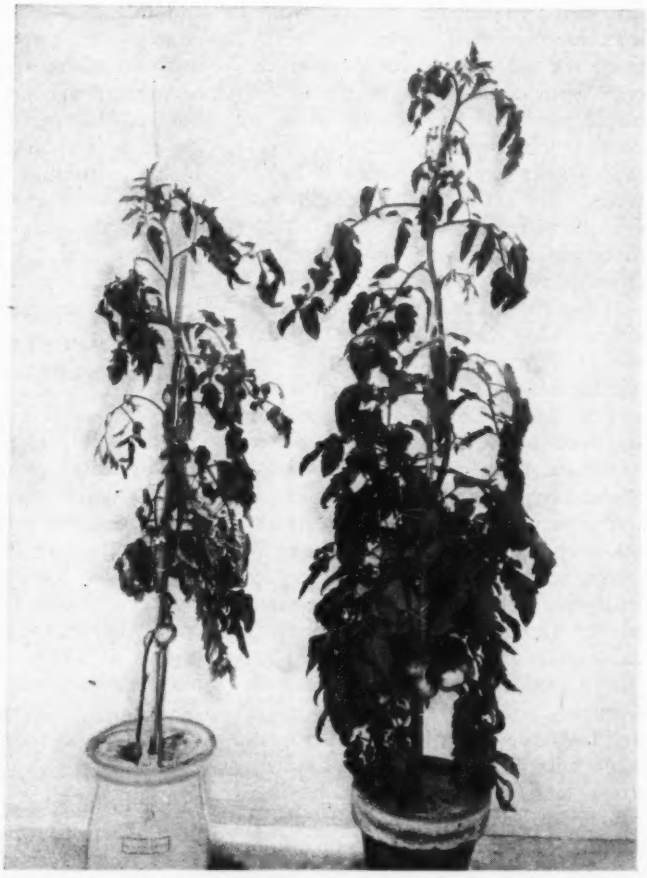
2%. Furthermore, some of these growers were getting good yields with all chemical fertilizers and no manure. What, then, is a good substitute for manure? We must do more than supply a substitute for the ingredients in manure. We must supply those ingredients so that plants have access to them as they do with manure.

Many tomato fields on the lighter soils in New Jersey made an excellent growth early during the past season, but stopped growing rather suddenly. There was plenty of moisture in the soil due to a number of fairly heavy rains. Where the fertilizer was applied previous to setting the plants, the moist weather made it possible for the plants to take in abundant plant food, with the result that they became very soft and succulent. Apparently the available nitrogen which had not been used by the plants was removed from the vicinity of the roots through leaching by the heavy rains, with the result that the plants suddenly stopped growing and in many cases showed nitrogen and potash deficiency smyptoms.

Where the fertilizer was applied in several applications as side-dressings, this condition did not occur. Apparently on the lighter soils, it is necessary to feed according to rainfall because nitrogen and potash do seem to be leached away, and unless it is replenished the plants show the effects of deficiency very quickly, particularly if the weather turns hot and dry. Irrigation does not help much unless more fertilizer is applied.

Soil fertility surveys on farms in certain localities indicate that growers are trying to grow tomatoes with insufficient lime. Calcium and magnesium are as necessary as nitrogen, potash, and phosphates for the growth of a big tomato crop. If lime has not

(*Turn to page* 44)



Showing the effect of too little potassium on tomatoes. As soon as the fruit was formed on the plant on the left, which received 5 p.p.m. of potassium, the leaves began to show deficiency symptoms, while the plant on the right which received 50 p.p.m. of potassium, never showed these symptoms.

The Committee on

Fertilizer Application

Meets in Chicago

RESEARCH work has shown that the proper placement of fertilizer, in relation to the crop, is of the utmost practical importance if maximum returns are to be secured from the use of the necessary fertilizers. With changes in the use of fertilizer, new problems of application are coming up for solution. In 1937, experiments were conducted in 28 states. By no means, however, have the answers been secured to all the problems of fertilizer placement confronting the farmers today.

It was, therefore, with considerable interest that the National Joint Committee on Fertilizer Application held its thirteenth annual meeting on November 29 in Chicago. The meeting was well attended by visitors and cooperators from most of the states where fertilizers are used. Following the report of the general secretary, the scope of fertilizer placement research activities in 1937 was reported. Following this were reports on methods of fertilizing fruits, experiments comparing granular and ordinary fertilizer, improvements in fertilizer distributing machinery, experiments involving the plowing under of fertilizers, comparison of fertilizer distributors, and a summary of fertilizer placement experiments on specific crops. Topics on extension work, publicity, and future work, concluded the program.

The committee has been working on the problem for many years, starting with hand placement of fertilizers. In 1929, however, due largely to the cooperation of Mr. G. A. Cumings and his staff of the U. S. Bureau of Agricultural Engineering, experiments in the machine application of fertilizers were inaugurated. This work has been conducted every year since, giving records of nine years of field work with the machine applications.

In view of the importance of this subject, the report of the committee is given here. Complete reports on the topics discussed will be made available in the near future.*

SCOPE OF FERTILIZER PLACEMENT RESEARCH ACTIVITIES —1937

Fertilizer placement research activities increased greatly during the 1937 season; major changes have occurred in the research programs; and further progress has been made in the survey of available fertilizer distributing machinery. These three features briefly cover the progress made by the committee in 1937, and are used as the outline of this report.

(1) Volume of Research Activities Increased.

Fertilizer placement studies have been continued for nine years, the volume of work increasing each year. In 1929 four experiments on cotton and corn were started in three states. In

*Reports will be compiled by the General Secretary of the Committee, H. R. Smalley, 616 Investment Bldg., Washington, D. C.

1931 studies on potatoes and beans were added. In subsequent years the list of machine-placement-of-fertilizer experiments has been gradually increased, until in 1937, 119 experiments were conducted at 62 locations in 28 states on 22 crops: alfalfa, lima, snap, string, wax and white beans, cabbage, cauliflower, celery, collards, corn, cotton, kale, lettuce, onions, blue grass pasture, peanuts, peas, Irish potatoes, sweet potatoes, soybeans, spinach, sugar beets, tobacco, tomatoes, and wheat.

The continued expansion of the work is shown in the table below and the location of current and past experiments on the map following. Among these experiments are several in which the trial of fertilizer depositing equipment was the primary consideration.

(2) Major Changes in the Research Program.

An important purpose of this report is to call to your attention the major changes that have occurred in the research program, which are three:

(a) The increased number of placement experiments already noted.

(b) The recent inclusion of granular fertilizers.

(c) Emphasis on more profitable placement studies; that is, having established side placement as among the best practices, how can this method be modified to secure still better results. Also, as on cotton, different methods of obtaining side placement.

Amplifying these three topics somewhat, the majority of the older experiments were continued, but because in some cases the work had progressed far enough and was no longer found to be necessary, the experiments were discontinued on potatoes in Maine, New Jersey, and Ohio; on Henderson bush lima beans in Maryland and Virginia, and on carrots in New York. Also there was some reduction in the number of experiments on corn in Indiana.

Out of the total of 119 experiments in operation in 1937, 48 on fertilizer placement and 9 on fertilizer particle size in combination with placement have not been previously reported. In most cases these new studies were inaugurated in 1937, but a few were

MACHINE APPLICATION OF FERTILIZER EXPERIMENTS
1929 TO 1937

Year	Number of States	Number of Locations	Number of Experiments	Crops
1929	3	4	4	Cotton, corn
1930	2	4	4	Cotton, corn
1931	13	19	23	Cotton, corn, *potatoes, beans*
1932	21	29	36	Cotton, corn, potatoes, beans, *sugar beets*
1933	19	33	37	Cotton, corn, potatoes, beans, sugar beets, *tobacco*
1934	19	40	54	Cotton, corn, potatoes, beans, sugar beets, tobacco, *tomatoes, cabbage*
1935	16	39	50	Cotton, corn, potatoes, beans, sugar beets, tobacco, cabbage, tomatoes, *peas, kale, spinach*
1936	16	41	68	Cotton, corn, potatoes, beans, sugar beets, tobacco, tomatoes, cabbage, peas, kale, spinach, *carrots, celery, onions*
1937	28	62	119	Cotton, corn, potatoes, beans, sugar beets, tobacco, tomatoes, cabbage, peas, kale, spinach, onions, *cauliflower, celery, collards, pastures, alfalfa, lettuce, peanuts, sweet potatoes, soybeans, wheat*

previously in progress but were not on the records of the committee. Your subcommittee, with other members of the Joint Committee, have been instrumental in organizing most of the new projects.

Some of the newer work is on the same plan in a number of states. For convenience these are called "general studies." Among such was a study with blue grass pasture in Indiana, Michigan, and Ohio, and on alfalfa in Michigan. Investigations were undertaken with sweet potatoes in Delaware, Maryland, and Virginia. In these experiments various placements of fertilizer were obtained by means of special fertilizer depositing equipment.

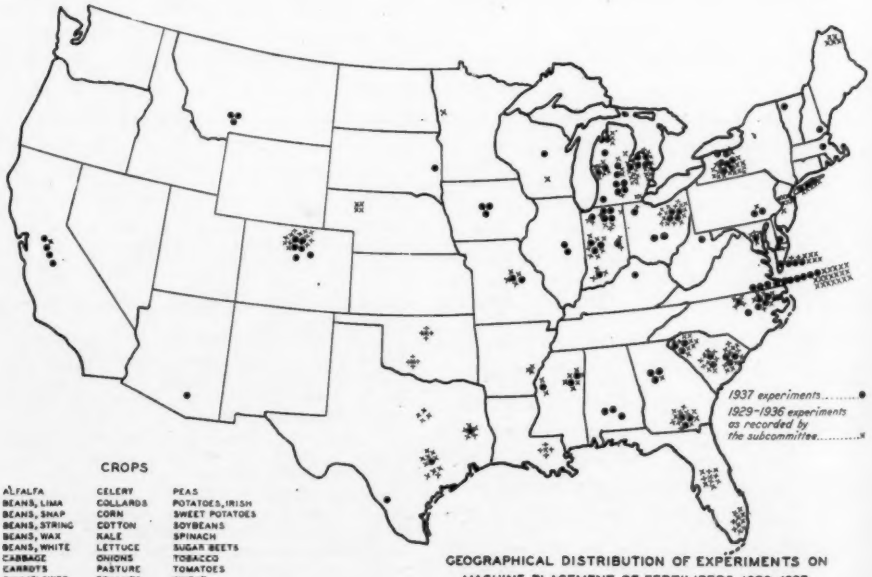
Another study of a general nature covers the comparisons of different sizes of fertilizer particles in connection with placement and was conducted with cotton in North Carolina, South Carolina, and Georgia, with potatoes in Michigan, New York, and Virginia, with tobacco in Pennsylvania, and with peas in New York.

Other projects not previously reported are as follows: alfalfa in Vermont, Fordhook lima beans in Georgia and California, cabbage in Virginia, cauliflower in New York, collards in Virginia, corn in Illinois, Kentucky, North Carolina, Iowa, and California, cotton in Alabama, lettuce in Arizona, onions in Texas and Virginia, peanuts in North Carolina, peas in Wisconsin, potatoes in New Hampshire, West Virginia, and Montana, soybeans in Ohio and Mississippi, tomatoes in Massachusetts, and wheat in Illinois.

Several of the previous investigations have been expanded and they now cover additional experiments with celery in New York, cotton in North Carolina, and sugar beets in Colorado.

New Fertilizer Equipment. In addition, the new studies include the study in South Carolina of commercial equipment for applying fertilizers to cotton; the studies in Montana and South Dakota relative to grain drill fertilizer equipment; the study in Ohio of fertilizer depositors combined with vegetable seeders; and the study in Montana of liquid phosphoric acid

(*Turn to page* 43)



GEOGRAPHICAL DISTRIBUTION OF EXPERIMENTS ON MACHINE PLACEMENT OF FERTILIZERS 1929-1937

This fine harvest of Johnson grass hay grew on a Black Belt farm in Dallas County.

Crops & Fertilizers in The Black Belt Section

By L. O. Brackeen

Editor, Agricultural Extension Service, Auburn, Alabama

EXTENDING nearly across the middle of Alabama and almost one-third across Mississippi from east to west lies a section of land known as the Black Belt, sometimes referred to as the "Prairie Belt," and at other times as the "Clover Belt." It covers part or all of 11 counties in Alabama and 12 counties in Mississippi, and is known as the Black Belt because of its fertile, black soil and not because of its dense negro population.

Before boll-weevils hit it several years ago, the Black Belt was a leading cotton section, easily producing a bale of cotton per acre. Since that time it has been pointed to as an excellent livestock-producing area, growing excellent hays, pastures, and legumes. It also is a leading honey-bee section, shipping more honey-bees and queens into northern United States and Canada than any other similar area in the United States.

Many statements, some true and some false, have been written and spoken about its black, fertile soils, its once extensive cotton fields, its potential possibilities as a livestock-producing section, its aristocracy, and its dense negro population, but until recently, very little was known about the crops and fertilizers best adapted to its peculiar soils.

Seven years ago the Alabama Experiment Station established the Black Belt sub-experiment station at Marion

(*Turn to page* 42)

Mississippi "Sweets" Need More Potash

By F. J. Hurst

Extension Editor, Mississippi State College, State College, Mississippi

THE value of potash in increasing yields of marketable sweet potatoes was impressively demonstrated in 1937 in field tests conducted by county agents and the state extension horticulturist in cooperation with growers in 14 Mississippi counties.

The fertilizer tests formed part of a 5-year program inaugurated by the Mississippi Extension Service and the Mississippi Experiment Station. The purpose of this program was the development of sweet potatoes as supplementary cash crop in areas where they were being grown on a commercial scale by improving the quality and increasing the yield of marketable potatoes through the use of approved cultural, harvesting, and marketing methods.

The program was organized in 5 areas embracing 14 hill counties. Under the plan each producer agreed to plant a minimum of 2 acres, and each community not less than 25 to 50 acres to assure production in carlot quantities.

The extension horticulturist prepared recommendations for growers covering soil selection, fertilizer usage, disease-free plants, and other cultural practices in an attempt to secure economical production of high quality potatoes.

The fertilizer tests were conducted on 18 farms in 14 counties. This report summarizes the data on 15 of these tests in which the potatoes were graded into No. 1 and No. 2 grades. In three of the tests the potatoes were not graded. For that reason, the data on these tests are omitted.

In the tests each farmer planted one acre on which he applied the kind and amount of fertilizer he commonly used in growing sweet potatoes, while on a second acre he added muriate of potash at the rate of 200 pounds per acre, except in one instance in which only 100 pounds were used. Most of the growers used from 400 to 800 pounds of 4-8-6 or 4-8-8 on the check acres.

Increased Yield

The value of potash on the great majority of the farms in the tests is seen in the average increase of 60.1 bushels of sweet potatoes per acre when 200 pounds of muriate of potash were added to the regular fertilizer. The average yield on the test farms from the regular potato fertilizer was 228.1 bushels per acre; the average yield when 200 pounds of muriate of potash were added was 288.2 bushels per acre.

Yields on some of the farms were low because the plants were set late and the crops suffered from drought during the latter part of June and during July and August. There was a slight decrease in yields from the potash plots in three of the tests. The decreases were on Susquehanna clay loam soil in the flatwoods section of the state, which is a very poor type of soil and ordinarily does not respond to potash fertilizer.

The increase in production resulting

from the addition of potash to the regular fertilizer was not the only gain obtained. The increase in production was largely a gain in production of No. 1 potatoes. Of the 900.8-bushel total increase on the potash plots, 727 bushels were No. 1, and 171 bushels were No. 2 potatoes.

Results of Tests

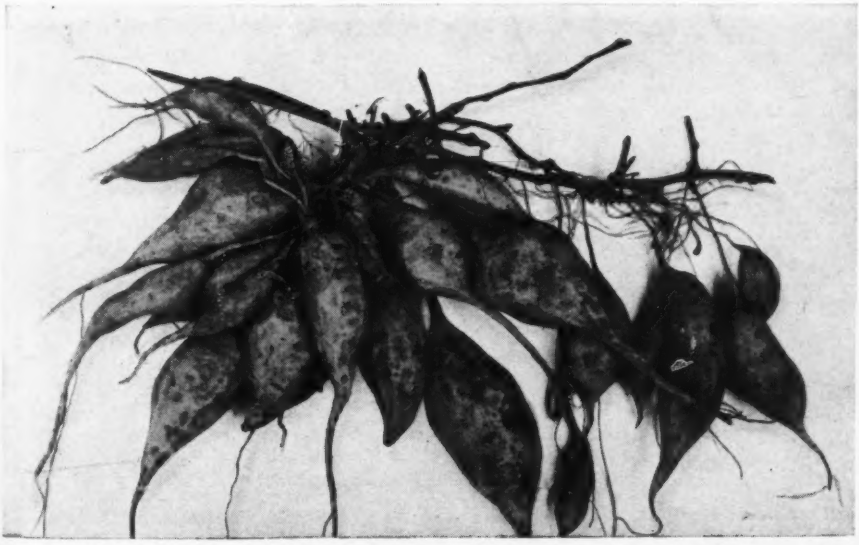
L. R. Brown, Bogue Chitto, produced 487 bushels on one acre, the highest yield in the tests. The potatoes were grown on Ruston silt loam soil. The check plot, fertilized with 600 pounds of 4-8-6, yielded 354 bushels. The use of 600 pounds of 4-8-6 and 200 pounds of muriate of potash produced 487 bushels, an increase of 133 bushels per acre. The potash added $66.50 to the value of the crop at 50 cents per bushel.

G. B. Northington of Belmont produced 452.6 bushels per acre for the second highest yield. Mr. Northington planted his potatoes on some of the best hill lands in the state. He used 800 pounds of 4-8-8 per acre on the check plot which yielded 419.8 bushels. The potash plot produced 452.6 bushels, an increase of 32.8 bushels. However, there was an increase of 63 bushels in No. 1 potatoes, showing the effect of the added potash on the quality of potatoes produced. It is interesting to note also that the plants in this test were not set until the first week in June. The yield doubtless would have been higher if the plants had been set earlier. The plants were set 10 to 12 inches in the drill in 3-foot rows.

Using 200 pounds of muriate of potash and 400 pounds of 4-8-6, W. A. Whitten of McCool made 393.8 bushels per acre, the third largest yield. The addition of potash in this test gave an increase of 115.2 bushels per acre, the second highest increase in the tests, and an added value of $57.60.

One of the best returns from the use of potash was obtained by W. D. Massey, Carthage. The application of 400 pounds of 4-8-8 gave him a yield of 227.7 bushels. But the acre which received 400 pounds of 4-8-8 and 100 pounds of potash produced 342.4 bushels, a gain of 114.7 bushels per

(*Turn to page* 41)



A sample of sweet potatoes from Mr. Northington's extra-potash plot showing the remarkable set and uniformity.

In 1938--Better Farming And Better Country Life

New Year Resolutions

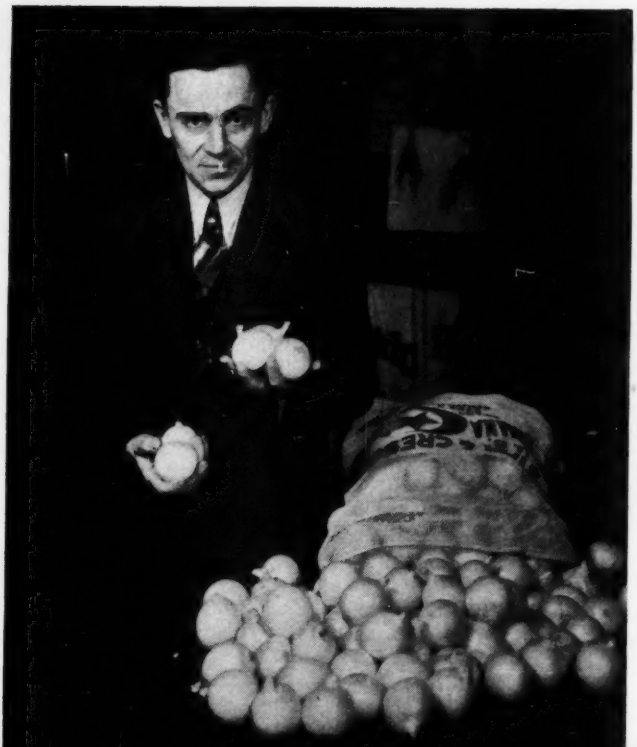
As suggested by A. B. Bryan
Clemson Agricultural College, Clemson, South Carolina

1. *Resolved:* that I will think beyond the present year in planning and executing my farming business.
2. *Resolved:* that having planned my work, I will work my plan so that I will not reap merely "a harvest of barren regrets."
3. *Resolved:* that I will follow wise George Washington's advice to "keep an account book and enter therein every farthing of receipts and expenditures."
4. *Resolved:* that I will not stake everything in one cash crop, whether it be cotton, wheat, corn, or something else.
5. *Resolved:* that realizing that a worn-out soil means a worn-out man, I will not rob my farm of its fertility.
6. *Resolved:* that I will raise home supplies to the fullest extent consistent with my land and conditions.
7. *Resolved:* that I will market as much of my farm produce as possible in the form of livestock.
8. *Resolved:* that if I swear at all I will swear at scrubs and swear by purebreds.
9. *Resolved:* that I will not expect other farmers to produce feeds for my livestock.
10. *Resolved:* that I will buy more farm machinery and make better use of it to enable me to save time for more work and more leisure.
11. *Resolved:* that I will terrace all of my land that needs terracing and will build up the waste places.
12. *Resolved:* that I will save money and time by taking better care of my farm machinery, tools, implements, and my livestock.
13. *Resolved:* that I will fertilize my crops intelligently and liberally for more economical returns from each acre.
14. *Resolved:* that I will plant more legumes and cover crops to help maintain the fertility of my land.
15. *Resolved:* that I will read and think more this year and thus learn to help reduce the high cost of ignorant farming.
16. *Resolved:* that I will provide more conveniences and comforts for the farm and home to make it more livable and more attractive for my family and my friends.
17. *Resolved:* that I will make the premises more beautiful by paint, shrubbery, trees, and flowers.
18. *Resolved:* that I will treat my woodland as a "field" and my growing timber as a "crop" and so "farm" it as to get needed timber and fuel by such handling as will improve and not injure the woodland.
19. *Resolved:* that I will join my neighbors in cooperative marketing to provide orderly sale of my crops and help prevent glutted markets.
20. *Resolved:* that I will be generous with any good farming ideas which I have by passing them on to my neighbors.

(*Turn to page* 43)

PICTORIAL

RAY HANSON, 1937 NATIONAL CORN HUSKING CHAMPION, SHOWS HIS STYLE IN THE CORNFIELD.



Perry Ort, Churubusco, Ind., displays a sack of Southport White Globe Onions which won 1st place in the Commercial Class at the Northern Indiana Muck Crops Show at Kendallville. He grew 70 acres of onions and used 500 lbs. of 3-16-24 fertilizer per acre.

A. F. Stephens, Agricultural Agent for the B. & O. Railroad, presents the trophy to the Champion Vegetable Judging team from Lowell, Ind. (left to right) Coach J. E. Little, Kenneth Duncan, Howard Holtz, Dick Keithley, and Jerome Echterling.

Beauty reigns annually at the Muck Crops Show. Edythe Franze, of Kendallville, Ind., Queen of the 1937 show, is pictured with her two attendents, Dona Belle Metz (left), of Albion, and Anaidine Pike (right) of Hudson.

Potatoes like these justify the cost of labor and fertilizer expended in their production. This sack of Katahdins, exhibited by Louis Ruderman, of Auburn, received 1st prize in the Commercial Pack Class at the Muck Show.

Above: Three guesses—what is the difficulty?

Below: When it's scallop time in Nova Scotia.

The Editors Talk

Looking Backward

Nearly everyone of importance has written or talked about practically every phase of economics in the past quarter. The views expressed are about as varied as the viewers. Opinions vary from the theory that our economic planners face a hopeless task to the conclusion that there is no real depression and thus no task for the social economist to perform.

At any rate, it sometimes appears that nearly everyone has become so engrossed in the cross-currents of the present trend that they have overlooked the accomplishments of the past year and the fundamental facts which undoubtedly will chart our economic course in the future.

Depression or no depression farmers are scheduled to chalk up the highest cash income they have received in seven years and the greatest purchasing power in many years. Farm income is expected to reach the 8 7/10 billion mark for this year, about 15 per cent under 1929 but equivalent to more than the 1929 figure in terms of goods farmers can buy.

One feature of this year's farm record is the fact that the increase in income is not due to drought or artificially reduced production, but rather to extremely favorable weather and increased production at prices high enough to compensate the grower. Many point to the increase in cotton production and the resultant drop in cotton prices as an indication of a weakened economic position. In one sense the cotton situation may be considered as an example of the resistance of our present economic structure to bearish influences. The world supply of American cotton is expected to reach the unprecedented figure of 25,000,000 bales in the 1937-38 season. The farm price has averaged about 8 cents. In the 1931 season American production reached 17,000,000 bales, and world supplies of American Cotton were in the neighborhood of 25,000,000 bales but prices dropped to an average of 5 7/10 cents per pound for the year. In the following year with production down to 13,000,000 bales and supplies still large, farm prices averaged 6 5/10 cents. The farm value of the cotton crop in 1931 was $556,051,000 and in 1932 $483,901,000. This year the farm value of the crop will probably reach $895,000,000, about $40,000,000 less than 1936, but when the $130,000,000 in subsidy payments are added the total will exceed 1936 by nearly $75,000,000. Hardly comparable to the situation during the two forementioned depression years!

Probably the most fortunate of all farmers are the tobacco producers. After a rather bad start early in the season the tobacco crop, enhanced by favorable weather, made splendid progress and stands to produce an income for the growers in the neighborhood of $260,000,000, approximately $35,000,000 more than last year.

Even though there has been an appreciable decrease in wheat prices, production in most areas more than offset the lower prices, and the purchasing power of this year's crop will exceed last year's short crop by nearly 33 per cent.

The corn belt farmers have harvested a bumper crop which is selling at greatly reduced prices on the cash market. However, this should cause no serious alarm, as long as live-stock prices remain at their current favorable levels. It is estimated that nearly 90 per cent of the crop is consumed on farms and little more than 15 per cent of the crop ever leaves the county in which it is produced. Ordinarily about 40 per cent of the crop is fed to hogs. The cash income from the corn crop thus depends to a large extent upon the prices received for live stock. In view of the ample supplies of feed, corn-belt farmers are winding up the year in a very favorable position.

With the increased income in the farmers' pockets and the larger purchasing power which it has brought, it is hard to understand how the country can go into an economic tail spin that cannot be checked before we crash into another depression. True it is that industrial activity has dropped about 20 per cent within the last quarter, but there are no figures that show that the consumers' purchases have fallen in any such proportion. For the year as a whole we are ahead of 1936 in nearly every department. Still it is said 1937 will end in a recession. Maybe our psychology is wrong. Who knows?

The Value of Farm Records

December is the month to bring out and go over the farm records and accounts of the year drawing to a close. Only with a clear picture of the results of the plans so carefully made at the beginning of the year, which only conscientiously kept records can provide, will the most intelligent programming for the next year be made. The past year's records should be studied with the idea of improving upon profitable practices and discarding those which have proved unprofitable.

Many State Extension Services are this month particularly emphasizing the value of farm records. "If production has been low and has been due to improper cultivation, planting, fertilization, or pest control, a farmer can change his operations for better results," says the Florida Extension Service. "If the quality of his products has been low and prices have been none too high as a result of this, he can take measures to produce higher quality crops. If his returns have been low because of inefficient marketing operations, he can get together with other farmers and try to work out a system that will increase his income and the income of his group."

The Minnesota Extension Service reports several instances of benefits which farmers derived from keeping farm records. One farmer, by increasing the acreage of his sugar beets and sweet corn, eliminating his hog enterprise and increasing his poultry, stepped up his earnings $1,400 per year. Another farmer increased his returns over feed from hogs by $1,051 in 2 years, after adopting swine sanitation. "While these cases illustrate how farmers have used records to increase their earnings," the Service explains, "records alone do not accomplish results. They do, however, reveal facts which make it possible for farmers to follow more profitable practices."

Farmers as a rule do not like too much "book work." However, they should be encouraged by all farm advisers in the keeping of at least fairly accurate accounts and records and inventories. There is a value in these records accruing beyond that to the personal advantage of the individual farmer. Each farm is in reality a test plot for the community. No test plot attains its full purpose unless its records disclose the feasibility of the practices involved.

REVIEWS

This section contains a short review of some of the msot practical and important bulletins, and lists all recent publications of the United States Department of Agriculture and the State Experiment Stations relating to Fertilizers, Soils, Crops, and Economics. A file of this department of BETTER CROPS WITH PLANT FOOD would provide a complete index covering all publications from these sources on the particular subjects named.

Fertilizers

A broad understanding as to the nutritive demands of apple trees is derived from New Jersey Agricultural Experimental Station Bulletin 626, entitled "Nutrition of Apple Trees," by M. A. Blake, C. T. Nightingale, and O. W. Davidson. This publication contains a wealth of constructive information concerning the effects of various nutrient deficiencies upon the growth of apple trees, and suggests sound principles of orchard nutrition. Adding to the wide usefulness of the contents are the colored illustrations denoting the definite symptoms of nutrient deficiencies in the apple leaves. The controlled investigations included detailed studies of tree responses to a complete nutrient solution in which all essential elements were supplied in proportions favorable to good growth and other treatments, each with respective deficiencies of calcium, magnesium, nitrogen, phosphorus, and potassium, but having all other essential elements.

It is to be realized that numerous factors must be considered in order to properly interpret the plant-food needs of orchard trees. Therefore, considering that practical use of the fundamentals of nutrition involves the soils, their natural fertility, seasonal conditions, moisture supply, temperature, light, stage of growth of the trees, and varietal properties, it is little wonder that many problems associated with this important phase of commercial orcharding exist. It is a common knowledge that a great majority of commercial apple orchards in New Jersey as well as other Northeastern States, are located on soils that are not very fertile. The authors point out that theories and recommendations of orchard fertilization have too often been founded upon observations and data accumulated under local and exceptional environmental conditions. They state that it is unfortunate that such views and recommendations too often have received general interpretation and application.

Since the days of Dr. Voorhees, Director of the New Jersey Experiment Station from 1893 to 1911, this station has consistently recommended complete fertilizers for fruit trees as a basic principle. Voorhees maintained that a fundamental of successful orchard practices was to make sure that all of the necessary nutrients were present in the soil in the proper proportions. He believed that it was a sound practice and good insurance to be liberal in the use of such nutrients as calcium, phosphorus, and potassium, rather than to run the risk of a deficiency, and to apply nitrogen according to the needs of the tree. Apple trees do not thrive well unless the soil is moderately fertile, with a proper balance and an adequate supply of nutrients and organic matter. That the fundamental principles of orchard fertilization advocated by Voorhees more than 40 years ago were sound, has been proven by subsequent research and the wide adoption of orchard fertilization practices based on the specific nutrient requirement of individual orchards. This bulletin might well be regarded as a

memorial to Voorhees as an individual and a challenge to sane thinking in the planning of a sound orchard fertility program wherever fruit trees are grown.

Liberal quantities of plant food are necessary for tomato production, according to Bulletin 676 of the Cornell (N.Y.) Agricultural Experiment Station, "Tomato Fertilizer Experiments on Long Island," by J. D. Hartman, Paul Work, and P. H. Wessels. This reports the results of 5 years' extensive work with tomato fertilizers. The data obtained from these experiments will provide fundamental facts governing the most economical fertilizer application for tomatoes to be grown on a number of soils on Long Island. The results showed that a basic application of about 50 pounds of nitrogen, 150 pounds of phosphoric acid, and 60 pounds of potash per acre should be used for tomato production on Sassafras silt loam and soils of similar properties. When any one of these nutrients was omitted from the fertilizer, the yields were greatly reduced. Since the soils of Long Island vary widely, the bulletin states local conditions must be taken into consideration in applying the above or any other recommendations. Additional nitrogen as a side-dressing may often prove profitable on lighter soils, for instance, and liming soils for tomatoes may favor indirectly the value of cover crops. The suggestions offered in this publication may be applicable for market tomatoes on similar soils elsewhere than on Long Island.

"Fertilizer Recommendations," Agr. Ext. Serv., Newark, Del., Inform. Card 36, Oct. 1937, C. A. McCue, Director.

"Potash and Phosphorus in Relation to Organic Matter in New York Orchards," New York State Agr. Exp. Sta., Geneva, N. Y., Bul. 679, Sept. 1937, R. C. Collison.

"The Agricultural Value of Specially Prepared Blast Furnace Slag," Agr. Exp. Sta., State College, Pa., Bul. 341, Mar. 1937, J. W. White, F. J. Holben, and C. D. Jeffries.

"Effect of Superphosphates in Conserving Nitrogen in Cow Manure," Agr. Exp. Sta., Burlington, Vt., Bul. 419, Apr. 1937, A. R. Midgley and V. L. Weiser.

Soils

"The Liberation of Plant Nutrients from the Soil as Affected by Alfalfa" is the title of Virginia Agricultural Experiment Station Technical Bulletin 60 by H. H. Hill. The investigations conducted in this work included the determination of the percentage of soil moisture, the accumulation of nitrate nitrogen in the soil, soil reaction under the different methods of treatment, the amount of water leached from 2-foot lysimeters, reaction values of the leachings, and the outgo of nitrate nitrogen together with the several plant nutrients carried away in the leachings from the soil treated with green and mature alfalfa. The experimental results presented cover a 4-year period with the employment of 14 lysimeters. The results showed that alfalfa added to the soil reduced moisture losses by bringing the soil into a good crumb structure and by increasing the amount of collodial material which retains water. Nitrification was found to be very active when the alfalfa was used either as a mulch or incorporated with the soil. Slight increases in soil acidity were observed immediately after the organic matter was applied, but it is significant that the acidity increases were only for a short duration. The soil treated with green alfalfa, mulched or turned, showed less nitrate in the leachings than when it received the corresponding treatments with mature alfalfa. The author found that the treatments with green alfalfa gave greater leaching values for calcium than any of the other plant nutrients. The magnesium outgo from the soil treated with organic matter was considerably greater than from the soil left in a fallow condition. Soil treated with organic matter showed substantial losses of potassium. In general, the incorporation of alfalfa in the soil or applied to the surface soil as a mulch results in an increased loss of plant nutrients as shown by analyses of the leachings. It is stated, however, that

if a growing crop is present, these losses may be largely avoided by the utilization of the nutrients by the crop.

"Liming Kansas Soils," Agr. Exp. Sta., Manhattan, Kans., Cir. 185, *Sept.* 1937, *H. E. Myers, A. L. Clapp, and F. E. Davidson.*

"Colloidal Properties of Soil Organic Matter," Agr. Exp. Sta., Columbia, Mo., Res. Bul. 267, *Oct.* 1937, *L. D. Baver and Nathan S. Hall.*

"Loss of Plant Nutrients From Peat Soil," Cornell Univ. Agr. Exp. Sta., Ithaca, N. Y., Mem. 206, *July* 1937, *B. D. Wilson and E. V. Staker.*

"Combining Heat and Formaldehyde for Soil Treatment," Agr. Exp. Sta., State College, Pa., Bul. 348, *May* 1937, *Kenneth G. Beachley.*

"Reducing Soil Erosion Losses on Pennsylvania Farms," Agr. Ext. Serv., State College, Pa., Cir. 191, *Aug.* 1937, *J. B. R. Dickey and Frank G. Bamer.*

"Chemical Composition of Soils of Texas," Agr. Exp. Sta., College Station, Brazos County, Tex., Bul. 549, *July* 1937, *G. S. Fraps and J. F. Fudge.*

"The Effects of Certain Lime Materials on the Leachings from Frederick Silt Loam Soil," Agr. Exp. Sta., Blacksburg, Va., Tech. Bul. 61, *Sept.* 1937, *W. B. Ellett and H. H. Hill.*

"Soil Survey of McDuffie County, Georgia," U. S. D. A., Washington, D. C., Ser. 1931, *No.* 28, *Aug.* 1937, *G. L. Fuller and A. H. Hasty.*

"Anchoring Farmlands in the Ohio Valley Region," U. S. D. A., Washington, D. C., Soil Conserv. Serv., Region 3, 1937, *J. S. Cutler.*

"Soil and Water Conservation in the Northern Great Plains," U. S. D. A., Soil Conserv. Serv., Region 9, 1937.

"The Nichols Terrace, an Improved Channel-type Terrace for the Southeast," U. S. D. A., Washington, D. C., Farmers' Bul. 1790, *Oct.* 1937, *Jerome J. Henry and M. L. Nichols.*

Crops

A number of pertinent queries concerning the growing of winter legumes in Louisiana are logically answered in Circular 171 of the Louisiana Agricultural Extension Division, entitled "Winter Legumes—Today and Tomorrow," by R. A. Wasson. The combined planting of vetches, Austrian winter peas, bur clover, and Melilotus Indica in this State in 1936 amounted to approximately 200,000 acres, or an increase of 60 per cent over the previous season's planting. It is expected that an additional 100,000 acres of winter legumes will be planted this fall. Only 80 per cent of the winter legumes planted could be called successful. The principal causes of failures given are improper inoculation, planting too late, failure to plant deep enough, poor drainage, and grazing during the growing period. Lack of proper liming and fertilization might well have been included by the author, judging from observations and frequent reports received.

The information in the circular is presented mostly in a question and answer form. These are simple statements which will clarify 25 common questions bothering most farmers. The concluding question, or the 26th, answers itself: "Had one rather look upon bare, unsightly cotton, corn, and cane fields from October to April, realizing that these soils are getting more unprofitable and uncertain each year; or isn't it far better for everyone to look upon dark-green, luxuriant acres of winter legumes, pleasing to the eye, beneficial to the soil and a dependable guarantee of larger yields and greater profits?"

The author recommends that phosphates and potash should supplement the cover crop for succeeding crops. On upland soils it is advised that the phosphate and potash fertilizers be used ahead of the cover crop, so that its growth will be increased and its success more certain.

A noteworthy publication stressing the characteristics of 24 kinds of our major potted plants and their culture is G. H. Poesch's Ohio Agricultural Experiment Station Bulletin 587, "Greenhouse Potted Plants." The bulletin is based upon the best accepted commercial practices in producing plants of the highest quality, together with the results of several years' experimental work at the experiment station and the Ohio State University.

Proper equipment and arrangement should be given much thought and planning for the economical produc-

tion of potted plants. Successful management after the equipment requirements have been taken care of involves considerable attention to watering and syringing, ventilation, temperature, soils and their reaction, fertilizers, symptoms of nutrient deficiencies, environmental grouping of plants and the like. Placing of seedlings or larger plants in pots and shifting plants from one size container to another entails much skill. These operations are said to be the most important mechanical phases in the commercial pot range.

Directions that facilitate acquiring the soil and fertilizer needs of the various pot plants are easily interpreted in the tables included in this publication. It is impossible to produce good-quality plants without supplying the proper nutrients in the soil. Nitrogen, phosphorus, and potassium are used by the plants in large amounts, and are, consequently, often lacking. A number of the minor elements are essential and should be supplied for proper plant growth when they are not contained in the ordinary fertilizer mixtures.

The best results obtainable may be had by following the simple formula of knowing plants, their requirements, and their enemies. A few rules for this formula include having a good-textured soil with sufficient nutrients applying fertilizers when light is abundant so that the necessary processes of food manufacture within the plant can take place, using concentrated fertilizers when the soil is moist and the plants are turgid, and taking caution against over-fertilization. Frequent nutrient tests of the soil to correlate the results with the condition of the plant before applying the fertilizer is another good rule, as is also the determination of soil acidity. Manure should be used only if it is well-rotted, its primary function being as a soil conditioner rather than a fertilizer. The author points out some generalizations which many plants exhibit when certain nutrient deficiencies appear. Definite deficiencies of the different nutrients are usually noted by the color of foliage, size and texture of stem and leaves, abnormal flowers, condition of root systems, and growth of plants.

"Chemical Investigations of the Tobacco Plant VI. Chemical Changes That Occur in Leaves During Culture in Light and in Darkness," Agr. Exp. Sta., New Haven, Conn., Bul. 399, *Aug.* 1937, *Hubert Bradford Vickery, George W. Pucher, Alfred J. Wakeman, and Charles S. Leavenworth.*

"Factors Affecting Easter Lily Flower Production in Florida," Agr. Exp. Sta., Gainesville, Fla., Bul. 312, *Aug.* 1937, *William B. Shippy.*

"Power in Soil Conserving Crops," Agr. Ext. Serv., Athens, Ga., Cir. 273, *Apr.* 1937, *E. D. Alexander.*

"House Plants and Their Care," Agr. Exp. Sta., Manhattan, Kans., Cir. 184, *Sept.* 1937, *Walter B. Balch.*

"Soybeans and Cowpeas in Kentucky," Agr. Ext. Service., Lexington, Ky., Cir. 292, *Mar.* 1937, *E. J. Kinney.*

"Commercial Strawberry Growing in Kentucky," Agr. Ext. Serv., Lexington, Ky., Cir. 295, *Apr.* 1937, *W. W. Magill.*

"The Lespedezas in Kentucky," Agr. Ext. Serv., Lexington, Ky., Cir. 297, *May* 1937, *E. J. Kinney, Ralph Kenney, and E. N. Fergus.*

"Legumes in Cropping Systems," Agr. Exp. Sta., Lexington, Ky., Bul. 374, *Aug.* 1937, *George Roberts.*

"Annual Report for the Year Ended December 31, 1936," *Agr. Ext. Serv., Lexington, Ky., Cir.* 300, *May* 1937.

"Fifty-second Annual Report of the Maine Agricultural Experiment Station, 1935-1936," *Agr. Exp. Sta., Orono, Maine.*

"A Histological Evaluation of Low Temperature Injury to Apple Trees," Agr. Exp. Sta., Orono, Maine, Bul. 388, *Aug.* 1937, *F. H. Steinmetz and M. T. Hilborn.*

"The Massachusetts Commercial Vegetable Grower," Agr. Ext. Serv., Amherst, Mass., Vol. 1, *No.* 7, *Nov.* 1937.

"The Quarterly Bulletin," Agr. Exp. Sta., East Lansing, Mich., Vol. 20, *No.* 2, *Nov.* 1937.

"Duluth Bush Fruits Thru Three Seasons (1934-1936)," *"Duluth Field Crops Thru Three Seasons* (1934-1936 *inclusive*)," *"Duluth Hay Crops Thru Three Seasons* (1934-1936 *inclusive*)," *"Duluth Orchards Thru Three Seasons* (*Jan.* 1937)," *"Duluth Rutabagas Thru Three Seasons* (1934-1936 *inclusive*)," *"Duluth Sunflower Tests Thru Three Seasons* (1934-1936 *inclusive*)," *and "Duluth Vegetable Crops Thru Three Seasons* (1934-1936),"

Agr. Exp. Sta., University Farm, St. Paul, Minn., Mimeo. Summary of An. Rpt. of Northeast Exp. Sta., M. J. Thompson, Supt.

"The Composition of Corn Fodder Grown in Drouth Years," Agr. Exp. Sta., Columbia, Mo., Bul. 390, Oct. 1937, L. D. Haigh and A. G. Hogan.

"Biochemical Studies of Photoperiodism in Plants," Agr. Exp. Sta., Columbia, Mo., Res. Bul. 268, Oct. 1937, A. E. Murneek.

"A Research Program, The Forty-third Annual Report of the Montana Agricultural Experiment Station, July 1, 1935 to June 30, 1936," Agr. Exp. Sta., Bozeman, Mont., F. B. Linfield, Director.

"Annual Report of the Board of Control for the Fiscal Year Ending June 30, 1936," Agr. Exp. Sta., Reno, Nev., 1937.

"Comparative Physiology of Actinomyces in Relation to Potato Scab," Agr. Exp. Sta., Lincoln, Nebr., Res. Bul. 92, Aug. 1937, Mitrofan M. Afanasiev.

"The Influence of Various Soil Factors Upon Potato Scab Caused by Actinomyces Scabies," Agr. Exp. Sta., Lincoln, Nebr., Res. Bul. 93, Aug. 1937, R. W. Goss.

"Annual Bluegrass (Poa annua L.) and Its Requirements for Growth," Agr. Exp. Sta., New Brunswick, N. J., Bul. 630, Sept. 1937, H. B. Sprague and G. W. Burton.

"Intensive Pasture Management," Agr. Exp. Sta., New Brunswick, N. J., Bul. 633, Sept. 1937, C. B. Bender.

"Apple Measles," Agr. Exp. Sta., State College, N. Mex., Bul. 251, June 1937, R. F. Crawford.

"Greenhouse Potted Plants," Agr. Exp. Sta., Wooster, Ohio, Bul. 586, Sept. 1937, G. H. Poesch.

"The Bimonthly Bulletin," Agr. Exp. Sta., Wooster, Ohio, Vol. XXII, Nos. 188 and 189, Sept.-Oct. 1937 and Nov.-Dec. 1937.

"The First Fifty Years of the Oregon Agricultural Experiment Station 1887-1937," Agr. Exp. Sta., Corvallis, Oreg., Sta. Cir. 125, Aug. 1937.

"Filberts," Agr. Ext. Serv., Corvallis, Oreg., Ext. Bul. 503, Apr. 1937, C. E. Schuster.

"Orchard Soil Covers," Agr. Ext. Serv., Corvallis, Oreg., Ext. Bul. 506, Aug. 1937, O. T. McWhorter, E. R. Jackman, and Arthur King.

"Growing Strawberries in Pennsylvania," Agr. Ext. Serv., State College, Pa., Cir. 181, Mar. 1937, J. Lupton Mecartney.

"Potato Grading," Agr. Ext. Serv., State College, Pa., Cir. 190, Aug. 1937, R. B. Donaldson and J. B. R. Dickey.

"Vocational Interests of Rural High School Pupils in Pennsylvania," Agr. Exp. Sta., State College, Pa., Bul. 342, Mar. 1937, C. S. Anderson.

"More Dollars for the Cotton Bale," Agr. Ext. Serv., Clemson, S. C., Cir. 158, Sept. 1937, C. V. Phagan and B. E. G. Prichard.

"Department of Agriculture-Immigration of Virginia," Richmond, Va., Bul. 354, Nov. 1937.

"West Virginia Pastures: Type of Vegetation, Carrying Capacity, and Soil Properties," Agr. Exp. Sta., Morgantown, W. Va., Bul. 280, June 1937, W. H. Pierre, J. H. Longwell, R. R. Robinson, G. M. Browning, Ivan McKeever, and R. F. Copple.

"Corn Production on the Campbell County Experiment Farm," Agr. Exp. Sta., Laramie, Wyo., Bul. 223, Sept. 1937, Paul K. Thompson.

"Report of the Secretary of Agriculture, 1937," U. S. D. A., Washington, D. C., Henry A. Wallace, Secretary.

Economics

During the coming months farmers and business men will plan their operation for 1938. In order to provide a sounder basis for such planning, representatives of the State agricultural colleges and the Bureau of Agricultural Economics, U. S. D. A., cooperate in preparing an annual outlook report for agriculture. In view of the current talk of another recession this year's report is especially interesting.

The prospects for agriculture during the coming season point to a fairly well-maintained economic condition. The domestic demand for farm products in 1938 probably will not be quite so favorable as it has been during the past year, but it is noted that conditions during the second half of the year probably will be better than in the first half. In spite of effects of military operations in the Orient and elsewhere, the foreign demand for American farm products may show some slight improvement. The general level of wholesale prices in the United States is expected to follow a downward curve and average slightly lower in 1938 than in 1937. Farm prices also are expected to follow the same course, and prices received by farmers will be on the average lower than last year.

In contrast to the expected decrease in wholesale prices, costs of production are expected to show some increase, and because of this, farmer demands for short-time credit will probably be greater than during 1937. The supply

of funds for this purpose apparently will be ample, and interest will be at low rates. The increase in cost will be due largely to higher wages, increasing prices of building materials, machinery, and possibly fertilizer.

The cotton situation has taken on an entirely different aspect since the beginning of the current season (August 1). At that time the world was carrying the smallest stock of cotton in 7 years. The world carry-over of American cotton had declined by about 700,000 bales, more than off-setting a 400,000-bale increase in the carry-over of foreign cotton. However, favorable weather, improved cultural methods, and other factors have resulted in the largest American crop on record, which means that the supply of cotton for the current season is the largest that has ever been recorded. The production of commercial cotton in foreign countries in 1937-38 is expected to total about 20,000,000 bales, or around 1,800,000 larger than the previous year's crop which was the record high up to that time, and is about an 84% increase over the average between 1928 and 1932. The increase in the foreign crop has largely occurred in China, Russia, Brazil, India and Egypt.

The level of mill activity in the United States, Japan and China is expected to fall off somewhat during the coming season, while on the other hand, increases are anticipated in Europe, India, and possibly a few other countries. World consumption of cotton is expected to attain the levels of 1936 and 1937.

In view of the anticipated carry-over and the world cotton situation, American cotton producers should use a great deal of caution in next year's plantings.

While the American wheat growers have been able to sell a fairly large crop on a strong market during the past season, the export situation may not be so favorable in the year beginning next July. World wheat acreage is still large, and with average yields the prospects are for lower prices next season.

The fortune of the tobacco growers rests largely in their own hands. In other words, the tobacco situation depends largely upon the ability of the growers to keep their 1938 production from getting out of line with consumption.

The outlook in the fruit industry is for heavier production, especially in the citrus belt. In view of this, it is indicated that the citrus producers should not expect much improvement in the prices of their product. However, the apple, pear, and peach growers may enjoy some improvement in prices. It is noted that the increase in citrus production in recent years has tended to offset the declines in apples and grapes. Strawberry production is likely to be larger in 1938 than it was in 1937. The October reports indicated an acreage for picking about 12 per cent larger than last season, and beds are reported to be in good condition in most areas, with the largest increase occurring in the intermediate States, late States, and second early States, with only a 3 per cent increase in the early States.

Another large output of commercial truck crops is expected for next year with a possibility of lower prices. The sweet potato acreage is expected to be increased, and with average yields a large crop will be produced and sold at a lower price. The acreage of truck crops has been increasing since about 1919, and during most of the period prices have tended downward. Apparently vegetable production has been taking the place of field crops in many cases where the latter have proved unprofitable, and the point has been reached now where growers should exercise careful thought to the higher cost and greater risks involved before shifting to commercial vegetable crops. The acreage planted to white potatoes in 1938 is expected to be about the same as planted this year, and in view

of the lower prices received during the past season, the acreage in the early and intermediate States may be decreased somewhat, which will probably be offset by slight increases in the late States. If present acreage intentions are carried out and average yields are recorded, the crop in 1938 will be about 365,000,000 bushels, or about 2 per cent below the average, and 9 per cent less than the crop of last season. Based upon prospective demand conditions, a crop of this size would result in prices and returns to growers somewhat larger than received for the large crop harvested in 1937.

The feed outlook is more favorable from the standpoint of the livestock producers than it has been in recent years. A much larger supply of corn and other feed grains than last season is on hand, whereas the number of animals to be fed is smaller. Larger quantities of mill feed will be available, and the hay crop is ample with exceptions of parts of the West.

Hog supplies will be smaller, but the weights will be heavier during the next season. The pig crop will probably be larger in 1938, and increases in slaughter supplies will begin to show by the end of next year in 1939. With more feed on hand, larger numbers of well-finished cattle will come to market in 1938, with a likelihood of some decline in these prices. The number of cattle at the beginning of next year is expected to be slightly smaller than this year and will probably represent a low point in the cycle of cattle production. Lamb feeding has increased, and more feed lambs will come to the market this winter than last. There probably will be fewer sheep and lambs from sources other than feed lots. It is not anticipated that the country as a whole will see any marked change in the sheep numbers during the next few years. This winter is expected to be a fairly favorable one for the dairyman, with prices of dairy products up somewhat and feed cheap. The short-time dairy outlook is favorable, and the longer-period outlook is moderately favorable.

Agricultural conditions during the coming year are expected to average from about the same as 1937 to slightly below. In general, however, it does not appear that we should anticipate any marked agricultural recession.

Deviating somewhat from the usual procedure in the Annual Report of the Secretary of Agriculture to the President, Secretary of Agriculture Wallace has set forth what he feels the past 5 years have demonstrated in the way of economic principles. In the words of the Secretary, "Federal legislation has given expression both to agricultural and to urban group-solidarity. Something more, however, remains to be done. It is necessary to obtain in legislation not only a more effective expression of various group interests, but also more adequate recognition of the interdependence of the major economic groups."

The report begins with "an analysis of the community of interest that exists between farmers and city dwellers," for it is "on this foundation . . . that we can begin to build security for the farmer and consumer." It is impossible, over the long run, for any economic advantage to accrue separately to either agriculture or to city dwellers, since the prosperity of one must be dependent in a large measure upon the relative prosperity of the other. A decrease in the purchasing power of the farmer results in a narrower market for industrial products and loss of work to the wage-earners, whereas extremely high agricultural prices without corresponding increase in consumer purchasing power results in a loss of market for agricultural products, which operates to the disadvantage of the farmers in the long run. Thus, extremely high wages are contrary to the long-time interest of wage earners; at the same time, very high farm prices are contrary to the best, long-time interest of agriculture. It

is of utmost importance that the agricultural program be based upon principles that will add to the general welfare rather than simply promote limited farm objectives.

It is the opinion of the Secretary that it is time for the farmers of the United States to "begin to build for the longer future." The nation is better equipped today, with the experience of the Agricultural Adjustment Act and the Soil Conservation Act to draw upon, to devise "a farm program that will keep the agricultural industry on an even keel." "This program must guard against shortages as well as surpluses. Our agricultural supply situation is very different now from what it was 4 or 5 years ago. Supplies of most foods and feeds are not excessive, and the continued assent of consumers to farm programs designed to give farmers a fair and stable income will depend on the willingness of the farmers to produce enough to keep the granaries full." It is on this principle that the theory of the "ever-normal-granary" is based. It will provide benefits not for the farmers alone but for industry and labor as a whole. The principle probably will work with the greatest degree of usefulness on corn and wheat. However, in a different manner it may be applied to cotton.

"This year's large production of wheat, corn, and cotton has reemphasized the necessity for a permanent crop-adjustment policy. It is again obvious that in years of normal weather our farmers can produce more of certain leading products than the market will absorb at prices remunerative to the growers." This truth was lost sight of temporarily as the result of the droughts of 1934 and 1936, but again we are aware of the fact that we are dependent upon an export market to absorb a considerable proportion of our cotton, tobacco, wheat, hog products, dried fruits, and many other commodities.

"The great problem is to discover how adjustment may promote balanced expansion, so that labor, capital, and natural resources can be employed and at the same time conserved." A suggested formula runs as follows: "Our national economic goal must be increased balanced production of the things that people really need and want (1) at prices low enough so that consumers can buy but high enough so producers can keep on producing, (2) with income so distributed that no one is shut off from participation in consumption, except those who refuse to work, (3) with scrupulous regard for the conservation of our remaining natural resources, and (4) by means characteristic of our traditional democratic processes."

In commenting on the current cotton situation and the marked expansion in foreign production, the Secretary points out that "among the forces that have stimulated the consumption of foreign at the expense of American cotton . . . must be included the disposition of cotton-consuming countries to buy cotton where they could sell manufactured goods in exchange. This country's high tariff made it practically impossible for them to do so here. Accordingly, as supplies became available they turned to Brazil, Africa, and India for larger quantities." It became more profitable to grow cotton than to grow coffee in Brazil and grains in India, Egypt, and Argentina. Relief for the cotton farmer must include an adjustment of our foreign trade policies. In the case of cotton the ever-normal-granary type of loan may not be exactly applicable, since in some circumstances it is best to move the supplies at a loss rather than allow them to accumulate. It may be necessary, if we are to minimize the effect of low world prices, to continue the use of some sort of adjustment payments.

Under land planning it is noted that the fundamental purposes in land policy are: "(1) To maintain the income of farmers from efficient, properly adjusted production; (2) to im-

prove the land-tenure system and give land operators more security in their jobs; and (3) to safeguard resources."

"A Sociological Analysis of Relief and Non-Relief Families in a Rural Connecticut Town," Agr. Exp. Sta., Storrs, Conn., Bul. 219, July 1937, Nathan L. Whetten and Walter C. McKain, Jr.

"Quarterly Bulletin," St. Bd. of Agr., Dover, Del., Vol. 27 No. 2, for Quarter Ending June 30, 1937.

"Minnesota Farm Business Notes. Using records to Increase Farm Earnings," Agr. Ext. Serv., St. Paul, Minn., Mimeo. 179, Nov. 20, 1937, Roland C. Bevan.

"Farmers' Cooperative Marketing and Purchasing Associations in Missouri," Agr. Exp. Sta., Columbia, Mo., Bul. 389, Sept. 1937, Edward G. Schiffman and Herman M. Haag.

"An Analysis of Montana Farm Prices," Agr. Exp. Sta., Bozeman, Mont., Bul. 345, Aug. 1937, P. L. Slagsvold.

"Economic Benefits of Irrigation from the Kingsley (Keystone) Reservoir," Agr. Exp. Sta., Lincoln, Nebr., Bul. 311, Oct. 1937, Frank Miller and H. C. Filley.

"An Economic Study of Land Utilization in Steuben County, New York," Cornell Univ. Agr. Exp. Sta., Ithaca. N. Y., Bul. 674, June 1937, W. E. Keepper.

"An Economic Study of Land Utilization in Rensselaer County, New York," Cornell Univ. Agr. Exp. Sta., Ithaca, N. Y., Bul. 675, June 1937, R. S. Beck.

"The Farm Business from 1929 to 1935 on One Hundred Forty-one Ohio Farms," Agr. Exp. Sta., Wooster, Ohio, Bul. 587, Oct. 1937, J. H. Sitterley and J. I. Falconer.

"Philadelphia Wholesale Fruit and Vegetable Markets," Agr. Exp. Sta., State College, Pa., Bul. 349, May 1937, R. B. Donaldson.

"Dairy Farm Organization and Management in Southeastern Pennsylvania," Agr. Exp. Sta., State College, Pa., Bul. 350, May 1937, Thew D. Johnson and J. E. McCord.

"Commercial Fertilizers in 1936-37," Agr. Exp. Sta. College Station, Brazos County, Tex., Bul. 553, Aug. 1937, G. S. Fraps, S. E. Asbury, and T. L. Ogier.

"A Description of the Agriculture and Type-of-farming Areas in Texas," Agr. Exp. Sta., College Station, Brazos County, Tex., Bul. 544, June 1937, C. A. Bonnen and B. H. Thibodeaux.

"Commercial Fertilizers," Agr. Exp. Sta., Burlington, Vt., Bul. 426, L. S. Walker and E. F. Boyce.

"Farm Business," Agr. Ext. Serv., Burlington, Vt., Vol. 4 No. 5, Oct. 1937.

"Cotton Used in Tire Fabrics," U. S. D. A., Washington, D. C., Mimeo., Oct. 1937, R. J. Cheatham and A. Mason DuPre', Jr.

3-Galactosidylcyanidin Puts Red in Apple Skin

IF AN apple has 3-galactosidylcyanidin it blushes. If it merely has 3-galactosidylquercetin it is usually yellow. Chemical tests by United States Department of Agriculture workers indicate that 3-galactosidylquercetin is present in yellow apples such as the Grimes Golden variety, but this particular substance is not identical with or responsible for the yellow color that we see. In red varieties the unseen coloring matter is acted upon chemically and changed to red idaein, which is a simpler name for 3-galactosidylcyanidin. They have not yet identified the conditions that cause this change from yellow to red.

Color in apples is important to growers and to consumers. For the grower there is the practical advantage that well-colored apples are not nearly so subject to injury by storage scald as are apples in which the color is imperfectly developed. Buyers have a decided preference for well-colored apples, whether they are yellow or red, and are willing to pay higher prices for them. There is good reason behind the preference. For the consumer, good color is a practical and easy guide to selection of good ripe fruit.

The chemical changes that are essential to the formation of good color are the changes that are also required to bring fruit to maturity and to develop flavor, aroma, and palatability. This research does not compare the merits of yellow apples and red apples. It does bear out the popular idea that to be good, red varieties ought to be red and yellow varieties yellow.

Clover Not a Field Crop Until After Revolution

ALTHOUGH mention of red clover is found in early colonial history, it probably was not until after the Revolution that farmers planted it as a forage, hay, and soil-building crop, according to records in the Bureau of Plant Industry.

An early history of Pennsylvania (about 1730) reports that little seed of any grass was sown, as the plow seldom was used to prepare for meadows; that red and white clover were propagated only by manure. But clover had been introduced before that. It was reported in the fields of Long Island in 1679. In 1749 it was growing on the hills and in the woods of New York.

From the early history of Virginia it is obvious that the production of hay was not of any great importance. Agriculture centered about tobacco. New lands were sought rather than methods of improving worn-out soils.

Future Is Promising for Healthier Plants

PLANT disease specialists are first to admit great gaps in their knowledge of the young science of breeding disease resistance into plants. But in spite of this, what they do know has proved valuable. Dr. G. H. Coons, of the United States Department of Agriculture, estimates that 17 crops are worth about $66,000,000 a year more because disease resistant varieties have replaced older varieties. He regards this estimate as conservative. In 1935 disease resistant varieties were growing on more than 55,000,000 acres—more than a quarter of all the acreage in these 17 crops. Some of the more conspicuous examples of gains from disease resistance are found in wheat, flax, sugarcane and sugar beets, lettuce and cantaloupes. In the sugarcanes and flaxes new varieties account for practically all the acreage. Improved lettuce and cantaloupes are used almost exclusively because diseases had made the old varieties worthless.

Plow Pleased Webster More Than Public Life

DANIEL WEBSTER was a firm believer in deep tillage. A century ago, convinced that plowing was too shallow, Webster developed a plow 12 feet long from the tips of the handles to the tip of the beam, with a share 15 inches wide, according to records in the Bureau of Agricultural Engineering. The plow was designed to turn a furrow 12 to 14 inches deep. Eight oxen pulled it.

Webster was delighted with his plow, and wrote: "When I have hold of my big plow . . . in a brush covered pasture and hear the roots crack, see the stumps go under the furrow out of sight, and observe the clean, mellow surface of the land, I feel more enthusiasm than comes from my encounters in public life in Washington."

Thomas Jefferson, too, was interested in plows. His proposal to have all plow moldboards made on the same pattern has been called "an era in agriculture and the root of all real progress" in manufacturing plows. Prior to this a farmer usually bought the wooden parts of his plow from a plowwright and had the iron parts put on by a blacksmith, neither of whom seemed to know what the other had in mind.

Alfalfa Meals Supply Vitamin A for Chickens

GROWING chickens need some form of vitamin A to make satisfactory growth. Birds allowed to range about the farm during the growing season usually pick up sufficient quantities of green feed, but birds confined or unable to get green feed should have some feed that is rich in vitamin A, say poultry specialists of the United States Bureau of Animal Industry.

Alfalfa-leaf meal is one of the most economical sources of vitamin A, when all feeds must be purchased, and may serve as the sole source of this vitamin for growing chicks. Other common sources of vitamin A, in addition to green feeds, are yellow corn and milk.

The percentage of alfalfa-leaf meal required in a diet, which contains no appreciable quantity of vitamin A from other sources, depends on the ability of that diet to support growth when vitamin A is adequately supplied and on the vitamin A potency of the alfalfa-leaf meal itself. This potency is influenced by factors such as the method of preparation, variety, soil, weather, and cutting. Of these, the first is by far the most important.

The best criteria of an alfalfa-leaf meal's vitamin A potency are: Age, color, and "brightness." Unfortunately, it is seldom possible for the purchaser to ascertain the age of the meal he buys. Although the color of an alfalfa-leaf meal is a fairly good index of the meal's vitamin A content, the potency decreases more rapidly than the greenness of the meal changes.

Although as little alfalfa-leaf meal as 1.5 per cent of the total ration may supply an adequate quantity of vitamin A to maintain chicks in good health and enable them to grow, it is unwise to depend on less than 5 per cent of an alfalfa-leaf meal of unknown potency.

Make Your Fish Pond Pay Dividends

(*From page* 12)

ingly brought out by a study in Illinois which showed that the abundance of fish in ponds was directly correlated with the price of the farm land—the price, of course, being directly dependent upon land fertility.

From the above it is evident, then, that the average fish pond should be fertilized. The amount and kind of fertilizer used will depend upon the fertility of the surrounding land. If the soil is poor more fertilizer will be required. Fertilizers have been used in Europe for many years, and a great deal of experimental work has been done there. Wolgemuth reports that in tests extending over a period of 7 years, 1915-1921, the fish production in fertilized ponds always exceeded that in other ponds, and that during the years of 1918 and 1919 there was 100 per cent increase in the

fertilized ponds. Fish culturists in Europe are pretty well convinced that it is a sound economical practice to use fertilizers for this purpose.

Fertilizer Requirements

There is, however, some difference of opinion as to what elements are most necessary. Naturally the type of fertilizer used will depend on the locality. Most experiments seem to indicate that best results are obtained when a complete fertilizer is used; i. e., potassium, phosphorus, and nitrogen. Experimental work done at Fairport, Iowa, in 1933 has shown that the production of black bass was increased 50 per cent through fertilization. The subject of pond fertilization is new and it is difficult to lay down definite rules. Usually, however, one can't go far wrong if the advice of county agents or agricultural demonstration agents is followed, since ponds usually require about the same type as would a garden.

Any good, complete fertilizer containing sufficient quantities of nitrogen, phosphorus, and potash may be used and should be applied at the rate of from 400 to 500 pounds per acre. The relative proportions of the above elements will, of course, vary with the fertilizer requirements of the region in which it is used. This material had best be used in the spring and early summer, and usually it is best to apply it in small amounts rather than all at once. If any fertilizer is used all at once there is danger of killing some fish because it causes a depletion of the oxygen supply. Then, too, if there is much seepage a great deal of the elements may be lost. It is probably best to scatter the material about the edges, so that rains will carry it in gradually.

It has already been mentioned that plants constitute an important link in the food cycle of fishes, but it should be understood that not all plants are desirable in fish ponds. Generally speaking the smaller, submerged plants are desirable because they furnish shade for the fish, escape cover for the fingerlings, and food for microscopic animals upon which fish feed. This is not so true of the larger plants, such as willows, bulrushes, cattails, etc. These plants take up much of the fertilizers placed in the water and also make the distribution of fertilizer difficult, since it is usually placed near the shore. Then, too, if a large amount of plant material dies and decays in the water the oxygen supply may be so depleted as to cause many fish to die. The latter is also true when too many algae die in the water as often happens in late summer, especially in ponds that are overstocked with fish.

Don't Overstock Pond

Right here is probably as good a place as any to call attention to the fact that a pond will support only so many fish. Most ponds will not yield more than about 50 black bass or about 100 sunfish or bream a year. The average is far less than this. The practice of obtaining countless thousands of fingerling fish a year from hatcheries and dumping them in small fish ponds is certainly a deplorable waste. A pond will support only so many, and the rest merely form food for the grown fish.

It might be well to consider what fish are most desirable in the farm fish pond. Generally speaking there are three which are outstanding in many respects. They are the largemouth bass, warmouth bass, and the bluegill sunfish. The term bream is rather generally used and is applied to a great many members of the sunfish family, many of which make good pond fish. Care should be taken at all times to eliminate predacious fish, such as gar and grinnel or bowfins. If such fish are present already, the pond should be seined or drained to get rid of them.

Certain Elements Affect The Growth of Turnips

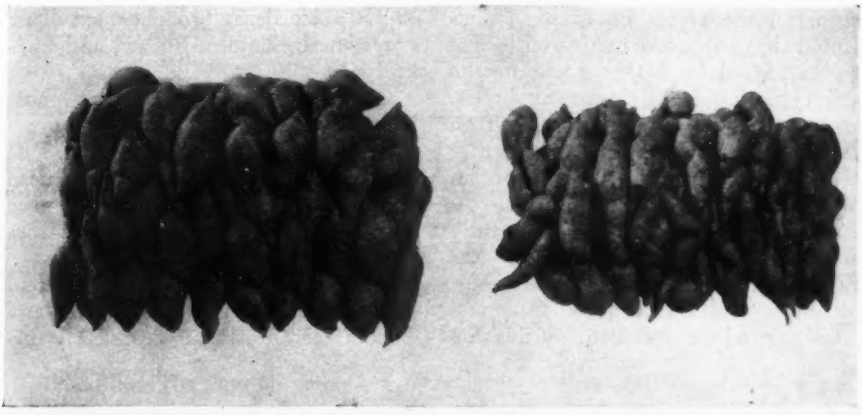
(*From page* 10)

apparently bring about a decrease in size of root development (Figure 4).

It would appear, therefore, that for the development of a satisfactory turnip, an adequate supply of nitrogen and potassium is the first or primary requisite, with phosphorus occupying a secondary but still important role, and calcium and magnesium a still less important position in the actual economy of the plant. Boron, as has already been pointed out, occupies a position of importance fully equal to that of nitrogen and potassium, particularly in the later stages of the plant's life.

Mississippi Sweets Need More Potash

(*From page* 21)



Left: High-quality sweets produced with extra potash. Right: poor type and low quality due to insufficient potash.

acre. The quality of the potatoes in this test was indicated by the fact that not a single Jumbo was found in the entire lot.

The tests were supervised by the county agents and Smith-Hughes teachers who directed the harvesting and attested to the weights and yields of the potatoes. S. W. Davis, assistant state extension horticulturist of Mississippi State College, also assisted in harvesting and weighing the potatoes.

In commenting on the tests, Mr. Davis said, "It appears that on most soils producers are using less potash than is necessary for securing the highest yields of marketable potatoes. Some soils did not respond to the added potash. These were very poor soils located in the flatwoods section."

Davis said he believed "these field tests are worthwhile and should be continued with a view of determining the potash limit for the most economical production of potatoes on soils that respond to potash and to determine definitely the soils that do not respond to potash."

Other growers who cooperated in

the tests included the following: C. H. Graves, Ackerman; Stanley Majure, Newton; E. L. Turner, Louisville; E. A. Brewer, McComb; A. C. Reeves, McComb; W. A. Boyd, Tylertown; R. E. Prestige, Summit; J. D. Fatherree, Bay Springs; J. C. Peeples, Eupora; T. S. Pigford, Kewanee; G. J. Hauser, Houston; H. E. Penick, Vardaman; G. H. Landreth, Vardaman; M. T. Cox, Smithville; Z. M. Ratliff, Sallis.

Some of the high yields obtained with increased yields resulting from added potash were as follows: Mr. Brewer, 300.3 bushels per acre, an increase of 42.8 bushels; A. C. Reeves, 287.7 bushels, a gain of 92.5 bushels; J. C. Peeples, 259.2 bushels, increase 109.5 bushels per acre; G. J. Hauser, 264.6 bushels, increase of 72 bushels; H. E. Penick, 275 bushels, a gain of 77 bushels; M. T. Cox, 257.7 bushels, an increase of 68.7 bushels.

Crops & Fertilizers in the Black Belt Section

(*From page* 18)

Junction, Ala., and an experimental field at Gastonburg, Ala., and now reports some of its findings. It has found that the area contains both lime and acid soils and that the different soil types require different fertilizers. Experiments have been conducted on two lime soils, Houston and Sumter clays, and four acid soils, Oktibbeha, Vaiden, Eutaw, and Lufkin clays.

The crops that are more generally suited to all types of soils in the Black Belt are corn, peanuts, soybeans, sorghum, and Dallis grass. Oats and alfalfa produce excellent yields on Sumter soils when properly fertilized, and oats yield well on the Vaiden soils. Lespedeza produces excellent crops on the Vaiden, Eutaw, and Lufkin soils.

The station has found that phosphate is needed on all the soil types for most of the crops tested. It has also found that there is a need for potash for most crops on the Sumter soil and for cotton and sorghum on most other soil types.

Lime is needed on all of the acid soils, especially Vaiden, Eutaw, and Lufkin, for nearly all crops. The in-

Black Belt sub-experiment station at Marion Junction boasts a well-managed pasture.

crease in yields from lime was especially large when legumes were grown.

Applications of nitrogen fertilizers increase the yield of non-legumes on all soils, however, the returns from nitrogen were not profitable except with oats on Sumter, sorghum and corn on Eutaw, and all non-legumes on the Vaiden and Lufkin.

Those interested in more details about the best crops and fertilizers for the Black Belt section may obtain a copy of Circular 78 entitled "Fertilizer and Crop Experiments on Certain Soils of the Black Belt," by writing Dean M. J. Funchess, director, Alabama Experiment Station, Auburn, Ala.

New Year Resolutions

(*From page* 22)

21. *Resolved:* that I will help to put the unity in community by taking and making opportunities to work with others to improve agricultural, economic, and social conditions.

22. *Resolved:* that I will take a vacation trip at least once during the year to see how other people farm and live in other parts of the state or country.

23. *Resolved:* that I will encourage my boys in club work and other progressive activities so that they may become better farmers than I am.

24. *Resolved:* that even in the face of discouraging experiences I will keep up my spirit and my faith that the Creator of the land and of all things animate and inanimate with which I work will not forsake the tiller of the soil.

Committee on Fertilizer Application Meets

(*From page* 18)

applications in irrigation water.

The survey on fertilizer application practices with fruit and nut trees which was started last year has been practically completed under the supervision of Dr. A. L. Schrader, and a report will be issued in the near future.

(3) Fertilizer Distributing Machinery Available.

In 1936 a report on a survey of available fertilizer distributing machinery was issued. This report listed the various manufacturers and the general specifications of the machines according to 23 different classes. As a continuation of this undertaking, all known fertilizer machinery manufacturers were requested by the subcommittee to either furnish current specifications on all fertilizer distributing equipment in production, or to indicate the changes which should be made to bring the committee's records up to date. A number of manufacturers have responded, and a revised classified list of fertilizer machinery specifications will be issued.

Summary. The scope and character of the new studies and the reorganization of previous projects will doubtless be fully described in progress reports covering individual fertilizer placement experiments to be presented in separate papers.

Fertilizer placement demonstrations and other extension activities, as well as fertilizer machinery developments, will be covered in other reports. This

report is limited largely to research activities.

Substantial progress has been made in fertilizer placement research, and expansion of the work under prevailing circumstances has perhaps exceeded the expectations of the committee. Your subcommittee has no specific suggestions to offer, but it is recognized that the program on improved placement of fertilizer is now only well started and will doubtless be a continuous one. It is therefore recommended, in general, that the work and efforts of the committee be progressively expanded.

SUB-COMMITTEE ON MACHINE PLACEMENT OF FERTILIZERS.
G. A. CUMINGS,
Chairman
H. H. ZIMMERLEY,
G. J. CALLISTER,
J. J. SKINNER,
FRED H. BATEMAN.

Growing Tomatoes With Chemical Fertilizers

(*From page* 15)

been used in the past, at least one-half ton should be used even though the pH may be satisfactory. Where a high (12%) phosphate fertilizer is used or the grower applies superphosphate in addition to his regular fertilizer, it may not be necessary to use lime as freely. One 12-acre field showed magnesium deficiency symptoms so badly this past season that many leaves dropped off the plants before a top-dressing of magnesium could be put on. It is difficult to put these materials on so that they will correct a situation quickly, unless a good rain gets the material into the soil where the roots will get it. Liming materials should be applied before the crop is set, so that they are mixed with the soil where they are accessible for the roots.

Lime and fertilizer experiments with tomatoes conducted by the Vegetable Production Department of the Experiment Station at New Brunswick for the past 3 years have shown an increase of 3 to 4 tons of tomatoes per acre in favor of lime where lime and no lime treatments were compared in each of the 3 years. Magnesium limestone has increased the yields more than high-calcium limestone by 1 to 2 tons in each of the 3 years.

Experiments have also shown that where the calcium content of the soil is raised, potash may become deficient, because the more rapid growth of the plants requires more potash. It was found that where the calcium content was maintained at a good level for tomatoes there should be at least 100 pounds of potash available per acre for the crop. This is equivalent to 1 ton of fertilizer having 5% potash or 1,500 pounds of a 7% potash fertilizer. If the season is favorable for a 12 to 15-ton crop of tomatoes even more potash may be needed. On the fertile soils, 1,500 pounds of fertilizer carrying 7% potash may be sufficient. On worn-out soils it probably would not be sufficient. For this reason abandoned fields brought into production with a liberal application of lime will often show potash deficiency symptoms.

Such fields having a low level of fertility very often will not respond to the fertilizer applied the current year. Special treatment the previous year is sometimes necessary to bring such fields into production.

Growers have access to a number of different kinds of liming material. Oyster shell commonly used is a high-calcium material, but should be very

finely ground. Continuous use of this material will result in magnesium deficiency.

Ground limestone when finely ground is very satisfactory. This can be obtained in either the high-calcium or high-magnesium form. Where the soil test shows a low magnesium reading, the high-magnesium limestone should be used. Limestone is about two-thirds as effective as the hydrated or agricultural limes. These also can be bought in either the high-calcium or high-magnesium form.

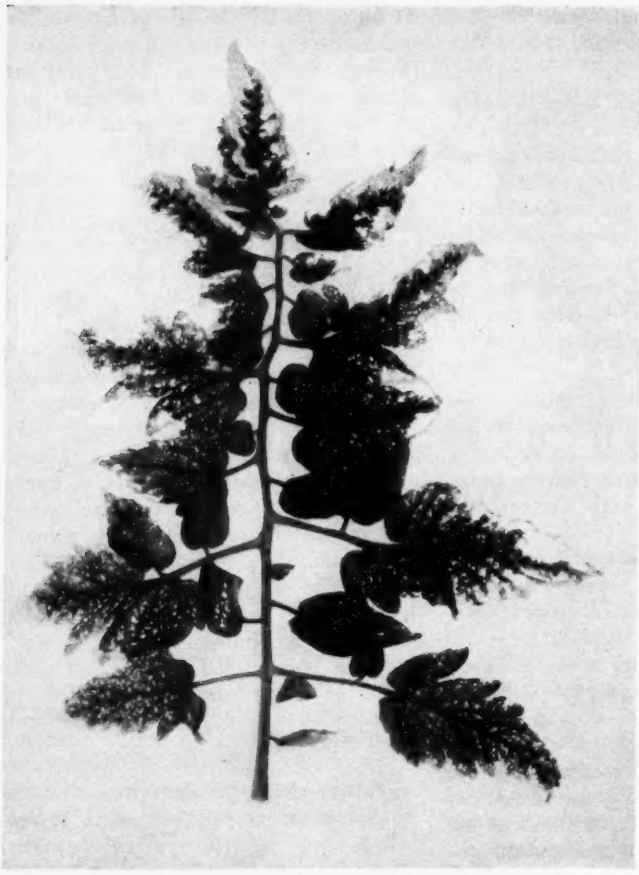
The diversity of vegetable crops with their specific requirements makes it difficult in some cases to follow a definite liming program. The combination of crops having high and low pH requirements makes it necessary to maintain a high-calcium level with other materials than lime. The 16% and 20% grades of superphosphate, gypsum, or calcium nitrate help to maintain a satisfactory calcium level. Tomatoes require considerable calcium, but will not grow on as acid soils as are necessary to control pox on sweet potatoes, but some growers try to grow both crops in the same rotation. It is possible in such rotations to use superphosphate or gypsum, but the cost will be greater and the crop of tomatoes will not be as good as where more lime can be used. There are cases where the pH is satisfactory, but the calcium content is too low. Gypsum would be a satisfactory substitute for lime, but due to the difficulty of getting the material, the grower must depend on superphosphate or calcium nitrate. Superphosphate contains considerable gypsum.

Organic matter experiments conducted the past 2 years at New Brunswick showed that where the field was planted to cover crops or corn the previous year, the yield of tomatoes was increased by 4 tons per acre. Where cultivated muck was added to supply organic matter, the yield was not materially affected. Cover crops apparently build up organic plant food which breaks down when plowed under and feeds the tomato plants gradually throughout the season. The yield on all the cover crop plots averaged 14.5 tons as compared with 10 tons where only lime and fertilizer were used, and 7.5 tons where only fertilizer was used.

From these results it would seem that a satisfactory method of growing tomatoes with chemicals would be the use of at least 1,500 pounds of 5-8-7 fertilizer on soil that is well supplied with calcium. If the calcium reading on the soil is high, it may be necessary to use a 10% or 12% potash fertilizer unless the soil has a liberal supply of potash in it. If a cover crop can be grown with extra fertilizer before the tomato crop is grown, or if ammonium nitrogen and lime or similar material can be plowed under with corn stalks or similar roughage the previous fall, the yield may be increased and equal those yields obtained where manure is used liberally.

Potash and Phosphorus

Potash deficiency symptoms in the field first occur on the young leaves. They turn light or yellowish green. The plants stop growing and become hard temporarily due to an accumulation of starch. As the deficiency becomes more severe, small peppery brown spots occur on the older leaves followed by yellowing and breakdown of the leaf margins. By this time the plants have used up their starch and become soft and may show rapid growth for a short time before the plants die. It was found that plants growing on soil having 20 p. p. m. of potassium in them showed the above symptoms. In other words, the potash level for tomatoes should be medium according to the quick soil test to insure a good crop and perhaps higher if the calcium reading is very high. This is easily corrected by a side-dressing of 200 pounds of muriate of potash.



Showing detail of potassium deficiency symptoms on an old tomato leaf.

Phosphorus deficiency is shown by a hard, somewhat stunted type of growth followed by the appearance of a deep purplish pigment on the young leaves and growing tips. The entire foliage may be intensely green and show no yellowing or dying of the leaves except in very extreme cases. On acid soils this has been corrected by the application of finely ground limestone. Enough phosphoric acid was released to start growth, provided moisture was not a limiting factor. On well-limed soils some form of phosphoric acid must be supplied as a side-dressing. However, unless this is done early it may not do any good.

Nitrogen deficiency symptoms are common on light soils following heavy rains. The foliage becomes light green and the older leaves turn yellow. The plants are quite woody. This is in contrast to magnesium deficiency where the plants remain quite soft and do not stop growing. The older leaves exhibit yellow blotches between the veins instead of the uniform yellowing characteristic of nitrogen deficiency.

Calcium deficiency symptoms vary with the severity of the deficiency. Extreme deficiency symptoms do not occur very often in the field. Certain early stages, such as brown roots or light green mottling of the foliage, may occur. The plants may be soft and watery and seem to lack substance. They do not respond to fertilizer treatment unless calcium is included in the mixture. Calcium deficiency is not always easy to diagnose, because it may include symptoms caused by an over supply of any of the other ions. If plants fail to respond to nitrogen fertilizers, it is an indication that calcium may be too low. If growers wish to get the most good out of fertilizers, they must be sure that the soil is liberally supplied with calcium. Calcium has many functions in the plant and in the soil, and its presence is necessary to get the most good out of potash salts. Experi-

ments in sand have shown that tomatoes make their best growth where the ratio of available calcium to potassium is approximately 5 to 1.

Candle Glow

(*From page 5*)

day-books, I find evidence that to her Christmas began along in gooseberry-canning time the summer previous and continued unabated of autumn evenings, as long as there was kerosene enough to light the lamps to sew by. To be sure, she didn't say right out loud in writing, but a fellow who lived along with her and noted her objectives is able to read into that old diary a heap more than her penny pencil ever dreamed she had up her sleeve.

I GUESS good mothers with healthy, careless kids are always like that, and my own wife's habit of never sitting down idly with empty hands proves that the best American women of all generations eternally think of the present in terms of our future comfort and preparedness.

Todays merge into tomorrows continually for them, and unless you save and work and plan ahead you might as well forget about wish-bones at Thanksgiving and plum-puddings at Christmas. To most men folks it only means a date on the calendar on which to sleep a little longer in the morning, but to the feminine guardians of the household it is the gracious culmination of a year's foresight and the reward of a devoted woman's unselfishness.

WE children, like all children outside of the goody-goody books, were self-centered introverts in respect to Christmas, because it was regarded as a juvenile holiday. It's rather belated to retract that attitude now, when the burdens of our parents to dole us out a slice of cheer can no longer be lightened. But a middle-aged penitent is better than none.

Though store presents were rare, our parents gave us home-craft articles which had their lives and momentary thoughts knitted or hammered into them. Weeks ahead of Christmas Mother spent her evenings after our bed-time slyly knitting stockings, wristlets, and scarves—those labors of love assumed gladly after a routine of daily tasks unknown to most women of the present era.

MOTHER'S kitchen was needlessly large, and the floor uneven and hard to keep clean. Water for cooking and for dish washing had to be carried from an outer well and a cistern pump in the "summer house." (Too often we "forgot" to fill the pails or split the kindlings.) Cooking was done over a low, cast-iron stove, with a sagging oven door and no thermometer, the pipes bubbling with dark brown creosote at joints and chimney piece. Every two or three days the half-dozen, greasy, coal-oil, table lamps had to be re-filled and the chimneys washed and polished. The parlor hanging lamp, with its purple bowl and crimson shade, circled with glass pendants, must be given the careful once-over. Chunks of firewood thumped down on the "zinc" mat near

the parlor heater left more litter and dust to be gathered up. Our dogs were forever nosing and tracking in and out; and our closet floors held more duds than the wall hooks intended for them. Yet somehow out of the dear past I cannot recall ever hearing Mother bewail her lot in life, even when all she got out of Christmas was what she sacrificed to give to us!

AND I see her yet, after a long day's trudging and reaching and bending—a frail body of willowy independence, standing at the threshold of the "sitting room," pushing her dark hair from a flushed and tired face, and remarking "how cozy it is to come in here and do our darning by the fire with all my family around me, and no wandering boys to burn the lights for." Or maybe some of us would grab away her work-basket and give her a library book to read aloud, because she had such a rich, soothing, kindly voice, and she would stop and sniffle with us at the sad parts of Tiny Tim or Little Nell.

And one winter she had Father search the woods for spruce boughs and sewed them neatly on card board letters she had cut out to spell, "Merry Christmas at Home," for a decoration in the dining room. That was the same year I had lost my faith in Santa Claus, but she clung to the old tradition for childhood's sake, and sensing that I was the last one and the youngest, I sheepishly hung up my home-knits behind the old base-burner just to please her once more.

Not one word of these things appear in the day-books of my Mother, however, for she was too busy and too practical to indulge in much else except the commonplace record of duties fulfilled.

AND as for Father, his life was spent in such a race to keep ahead of debts, despair, and chilblains that any philosophy or sentiment he had was reserved for the evening circle or the holiday reunion. But he made his plans for Christmas giving also, the best he could, using old packing crates, angle irons, and tin scraps to fashion wobbly sleds; or carving pine splinters into funny, spraddling dolls for Mother to dress up in rags and remnants.

Father was denied a bookish education, but he wanted us to have a few books each Christmas, which he usually bought himself. On my shelves today are just a few leftovers from my boyhood fiction favorites. Here is one of them, bound in faded red with coarse, thick leaves, bearing the title, "Tanglewood Tales of Hawthorne;" the fly-leaf having mother's script, "Christmas 1900, from your Father, with good wishes." But on the back inner cover is left a pasted label, "I was bought at the Fair store," with a dim notation by the sales clerk, "25 cts." Pray after all, what was "25 cents" if you had a kid to educate?

Many times since then I have met these heroes of Hawthorne's classic fables, dressed in finer garb and presented in nobler folios. Yet the Golden Fleece and the greedy Minotaur, Ulysses and the crafty sires, have never stepped forth in more dramatic pageantry than they did upon our first acquaintance at Christmas thirty-seven years ago!

THAT'S one reason why I never sniff at dime stores or judge a gift by the price-tag it dangles. And to be at once thoroughly Scotch and perfectly satisfied is surely a comfortable way to greet the Yuletide.

Hoping that you are the same, I close with deep gratitude for the space extended to me and a hand clasp for my known and unknown friends. To each and all of you and every kith and kin of you, may your rafters ring with melody, your eyes be bright with candle glow, and your hearts be warmed with hope and courage! Merry Christmas!

TRUE TO FORM

A Yankee was on a Christmas walking-tour in Scotland. Snow had fallen and he was struggling along a narrow road when he met a Highlander.

"I guess, friend, I sure am lost!" he said, plaintively.

Scot: "Is there a reward oot for ye?"

American: "Nope."

Scot: "Weel, ye're still lost."

"Heah, Rastus, is that quatah I borrowed from you two years ago."

"Y'all bettah keep yo' money. It ain't wuth two-bits for me to change mah opinion of you."

Mr. and Mrs. John Smith and family have returned from an extended trip through southern California. The entire trip was made without car trouble excepting that in crossing the Teton the mud was found deep and Mr. Smith tore out his rear end.

POOR DICTION

Lady (more or less): "Doesn't that little boy swear terribly?"

Another Little Boy: "Yes'm, he sure do. He don't put no expression in it at all."

Thieves who ransacked a golf club took away every bottle of whisky and beer in the place. The other 18 holes were not touched.

Nora—"If you like his attentions, why don't you marry him?"

Flora—"Because I like his attentions."

Englishman: "I say, what are they doing?"

American: "They're dancing."

Englishman: "They get married later, don't they?"

LET'S HOPE SO

Mose: "I hear you all got a new boy at yo' house."

Rastus: "Yes, suh—sho is a fine boy, too."

Mose: "Do he look like you?"

Rastus: "Sho he look like me." (second thought) "He bettah."

At the convention you can always lead a delegate to water—but he won't like it!

Ed: While we're sitting in the moonlight, I'd like to ask you—

Co-ed: Yes, darling?

Ed: If we couldn't move over. I'm sitting on a nail.

My nose doesn't breathe;
It doesn't smell;
It doesn't feel
Very well.
I am discouraged
With my nose;
The only thing it
Does is blows.

Potash Deficiency Symptoms

By ECKSTEIN, BRUNO *and* TURRENTINE

(A new publication—248 pages in German, French, and English—profusely illustrated with 55 plates in 4 colors and 41 striking figures in black and white.)

This work presents comprehensive information on characteristic potash deficiency symptoms appearing on the most important cultivated crops. The comments accompanying each color plate make this a very practical hand-book for identifying potash starvation as it appears on 45 different crops.

The first part of the book is devoted to the general symptoms of potash deficiency and includes chapters on: 1—External symptoms and modifications of the inner structure of the plant; 2—Secondary effects of potash deficiency; 3—Potash deficiency and the market value of crops; and 4—Pathology of potash deficiency. The second part is concerned with the potash deficiency symptoms on various cultivated crops, including: 1—Corn and other cereals; 2—Fruit trees; and 3—Vines. The colored plates illustrate potash deficiency symptoms on wheat, rye, oats, barley, rice, corn, alfalfa, red clover, crimson clover, white clover, timothy, canary-grass, horse bean, soybean, sugar beet, potato, turnip, grape vine, apple, orange, tangerine, red currant, gooseberry, strawberry, tomato, onion, carrot, spinach, celery, chillies, cucumber, white cabbage, red cabbage, Brussels sprouts, curly kale, Savoy cabbage, cauliflower, bean, pea, cotton, flax, sugar cane, coffee, tobacco, and peppermint. A colored chart shows the relative removal of N, P_2O_5, and K_2O by 56 different crops.

This book will be of particular value to all interested in the problems of plant nutrition and fertilizer usage, including teachers of vocational agriculture, county agents, research workers, and members of the fertilizer trade.

Bound in half leather . . . . . Price $2.25

B. WESTERMANN CO., INC. 24 West 48th St., New York, N. Y.

Printed in U.S.A.